

Google SketchUp Teacher Guide



Suggested Projects for Your Classroom

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Google SketchUp Design Project: Grades 1 - 5



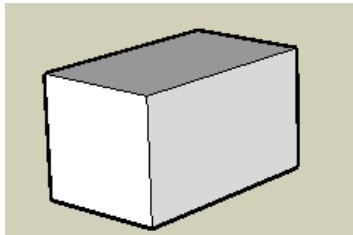
The first thing kids this age like to do in SketchUp is make a basic house and try out different colors and materials. They also love making windows and doors, and trying out the translucent colors. This is the perfect project to get them started using SketchUp and get their creative juices flowing - by using just a few basic tools kids can quickly design a fun, colorful house. (And it won't take long for them to start designing much more complex ones!)

If you need some basic information on downloading Google SketchUp, or about its user interface and basic tools, please see our printable "Intro to SketchUp" PDF.

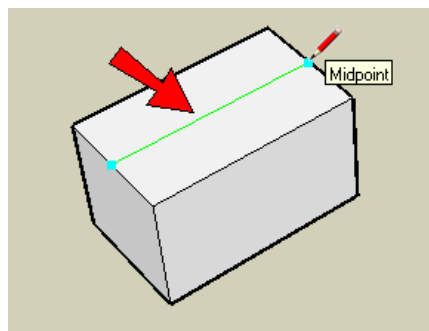
The PC version is at www.3dvinci.net/SketchUp_Intro_PC.pdf.

The Mac version is at www.3dvinci.net/SketchUp_Intro_Mac.pdf.

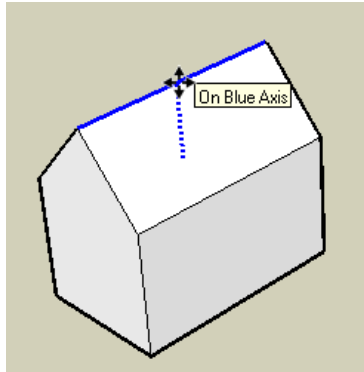
1. Start with a **Rectangle**, and **Push/Pull** it up to a box.



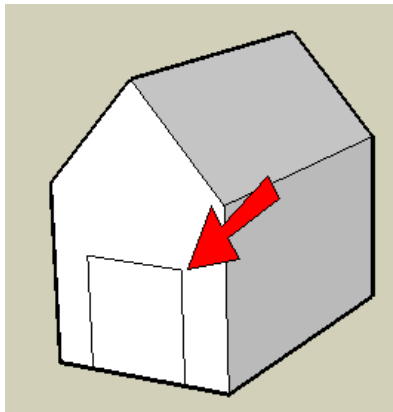
2. To make the roof, start with a line on the roof between midpoints.



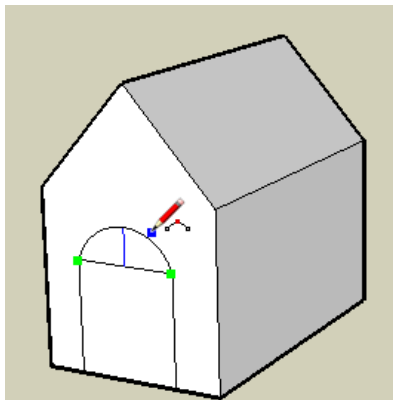
3. Use **Move** on this line, pulling it up (in the blue direction) to make the roof.



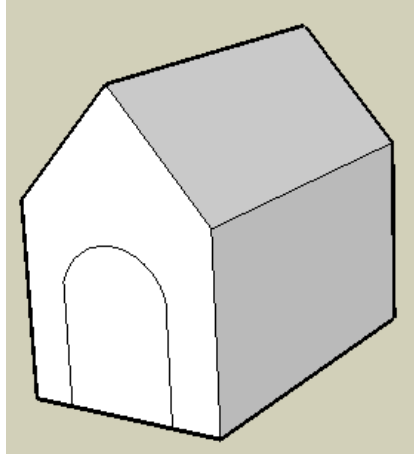
4. Add a rectangle on the front face, to make a door.



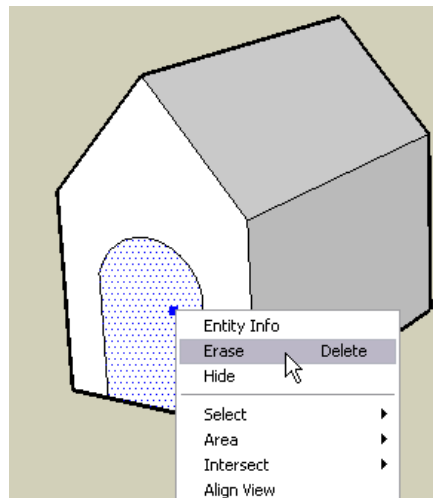
5. To make a more interesting door, add an arc at the top (use the **Arc** tool).



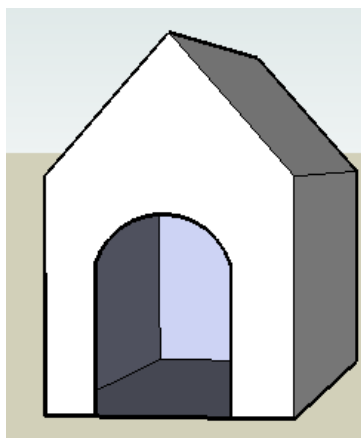
6. Use the **Eraser** tool to erase the top edge of the rectangle, so the door is one face.



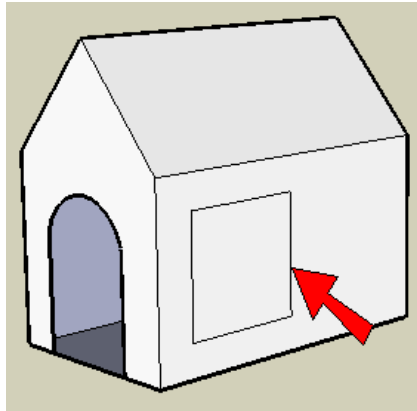
7. To remove the door face, right-click on it and choose **Erase**.



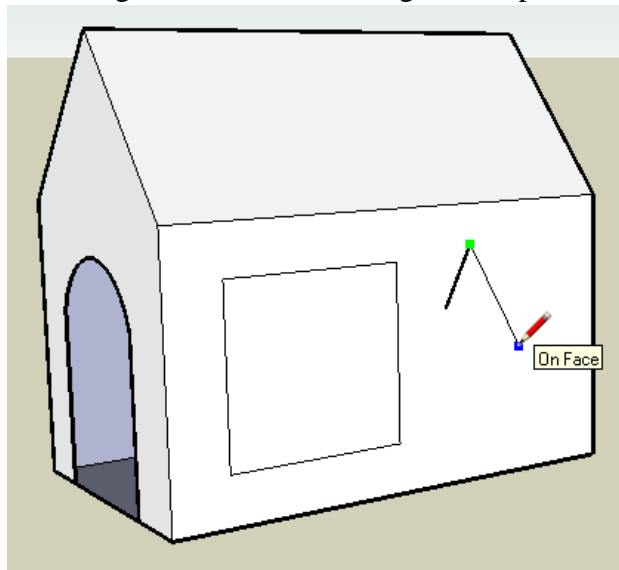
Now you can see into the house.



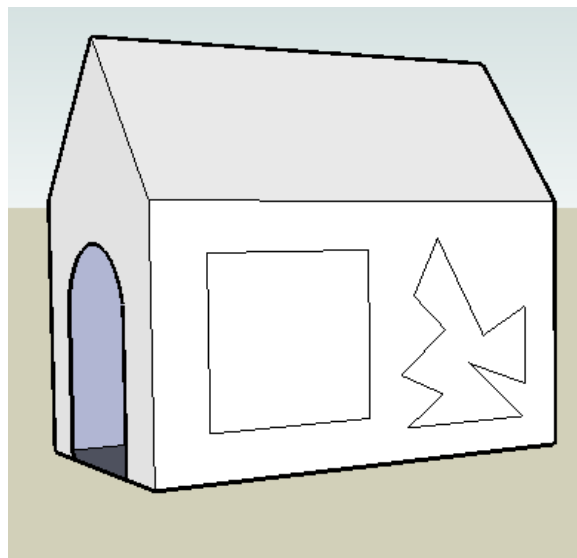
8. To make a window, add a rectangle on the side.



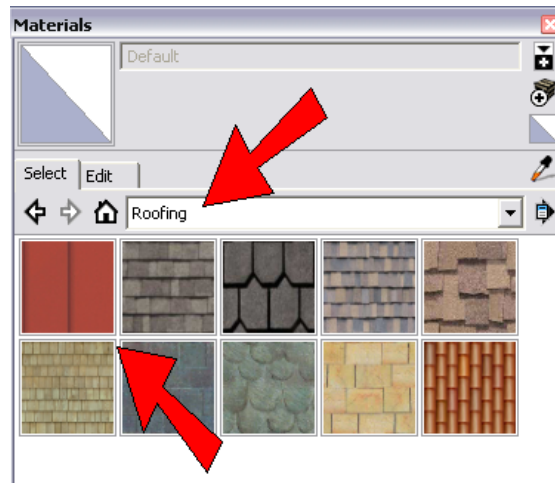
9. Of course, windows don't have to be rectangles! Use **Line** and make some strange shape for a window. Be sure that you see “On Face” while making lines, or the lines might end up sticking out of the house.



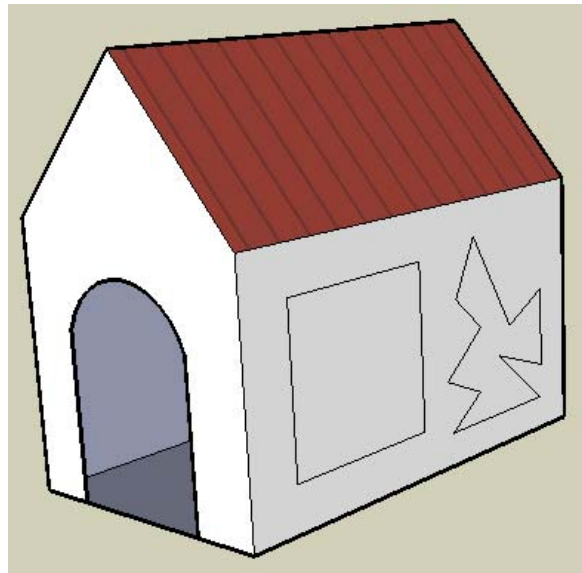
10. Be sure to end the window shape where you started. If your lines are correct, the edges around the window will be thin.



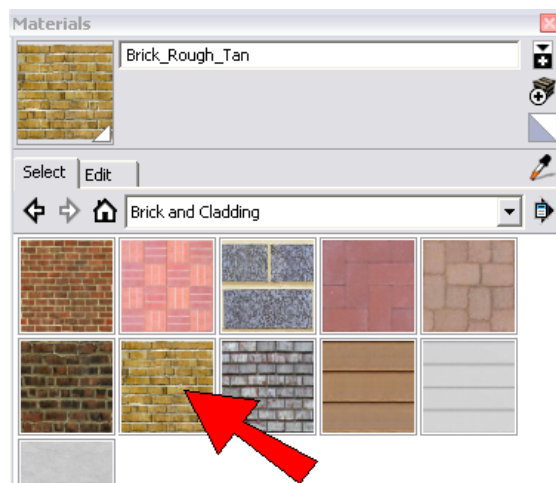
11. Now we can color our house, starting with the roof. Click the **Paint Bucket** tool to open the **Materials** window (**Colors** on the Mac). Open the “Roofing” folder and click one of the swatches (I’m using the red metal roof).



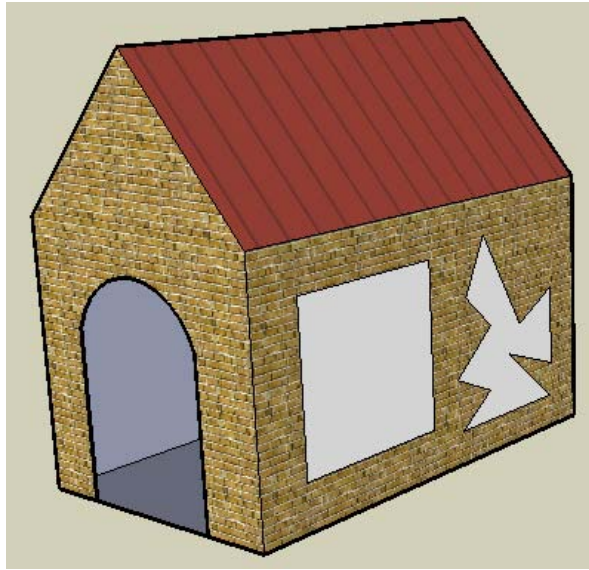
12. Then click the roof face (don't forget to paint both sides of the roof).



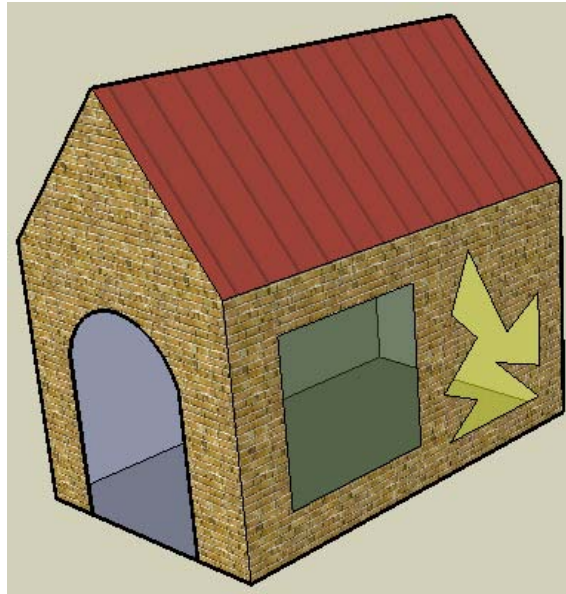
13. For the walls, I'm using tan bricks from the “Bricks and Cladding” folder.



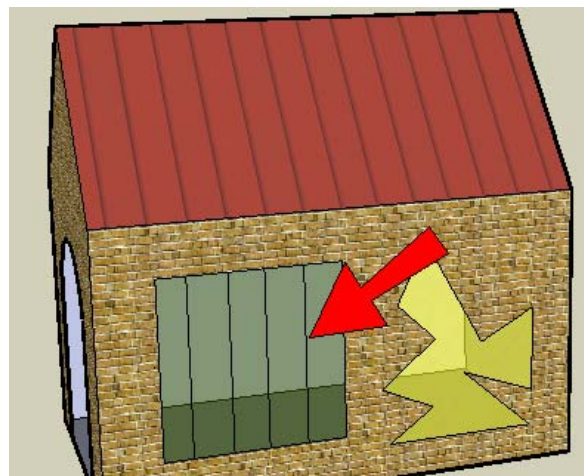
Here are the painted sides of the house:



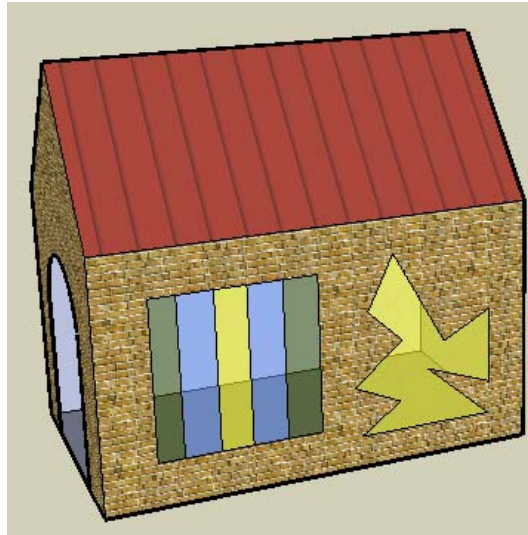
14. For the windows, you can use colors in the “Translucent” folder.



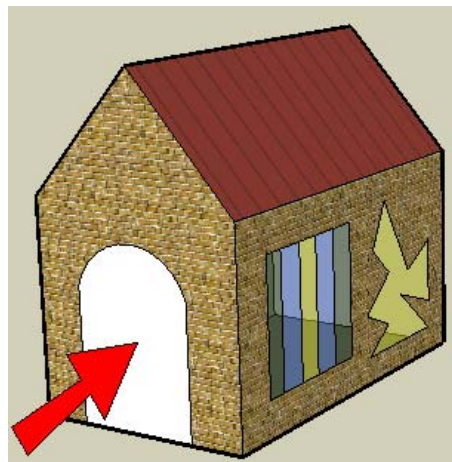
15. These windows are so plain - let's make them more interesting. Add some vertical stripes to this window:



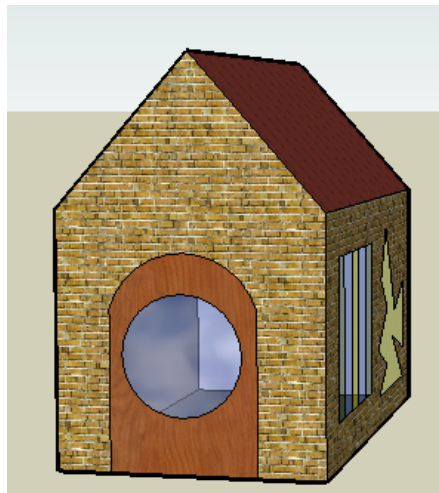
16. Then paint the stripes using different translucent colors.



17. If you don't want people to see straight into your house, you probably want to replace that door. Just use **Line** to redraw any of its edges, and the face comes back.



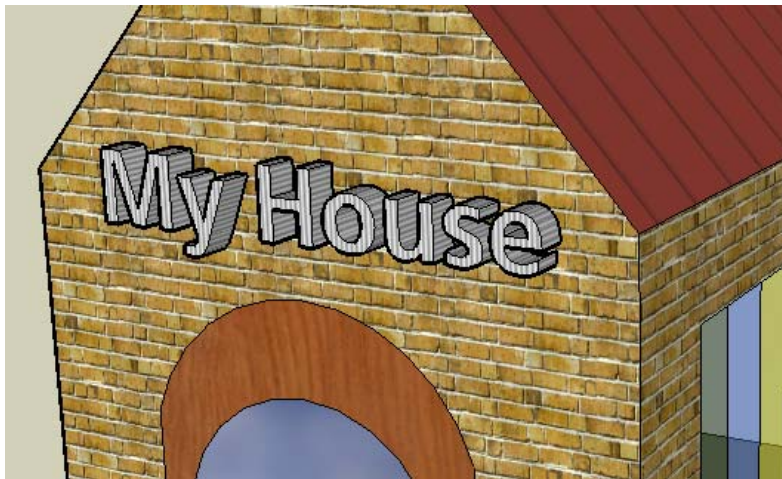
18. To dress up the door, you can add a circle for a window. I painted my door with cherry wood from the “Wood” folder.



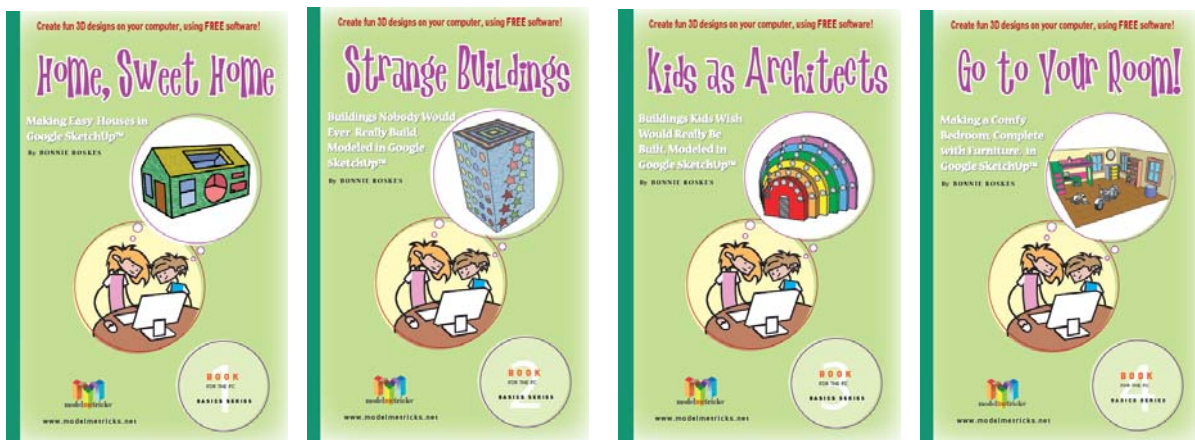
19. To personalize the house, you can add text using the **3D Text** tool.



3D Text requires that you enter a specific font and size, so you might have to try a few times to get the exact text you want. It also comes into the model as a component, so if you want to change it, you need to edit the component first (or explode the component).



If you like this project, please check out 3DVinci's ModelMetric's Basics Series (http://www.3dvinci.net/ccp0-prodshow/MBB_PDF.html). These books will show you how to create basic objects such as houses and buildings, and provide a great introduction into groups and components.



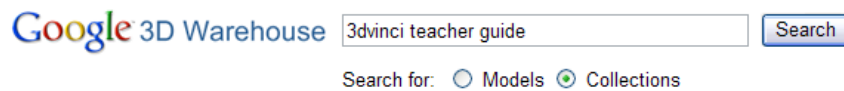
And if you want to receive three ready-to-use projects like these each month, sign up for our SketchUp Projects of the Month subscription (<http://www.3dvinci.net/ccp0-prodshow/POM.html>).

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<http://sketchup.google.com/3dwarehouse>.

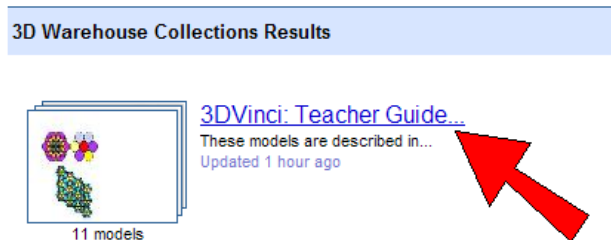
- Click [this link](#) to see the entire Warehouse collection of models used in the Teacher Guide.
- Click [this link](#) to locate this exact house model in the Warehouse.

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1. Open the 3D Warehouse.
2. In the **Search** field, type "3dvinci teacher guide" and click **Collections**. Then press Enter or click the **Search** button.



3. Open this link:



4. In the collection, find the model you want, and open or download it.

Google SketchUp Design Project: Grades 6 - 9



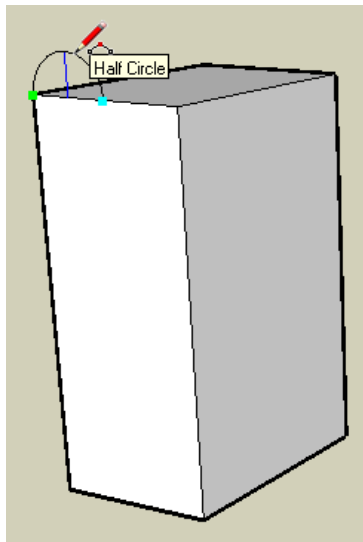
This age group can make relatively complex designs, so it's important that they learn good design practices. One of the most important features of SketchUp is components, which are essential to use when you have objects that repeat. Components provide flexibility; they enable you to make quick changes to multiple objects at once, plus they keep the file size from getting out of control.

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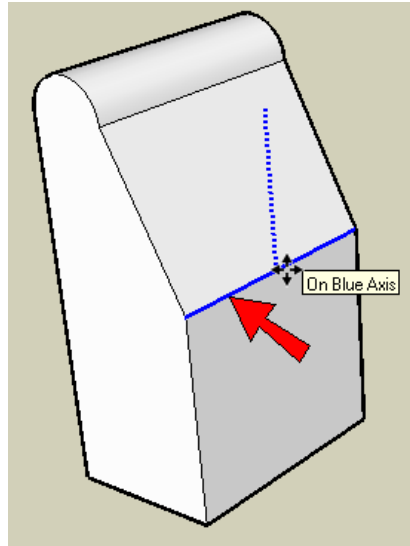
The Mac version is at www.3dvinci.net/SketchUp_Intro_Mac.pdf.

1. Start with a tall building, and use **Arc** to make a half-circle on top like this (make sure the arc is drawn in the blue direction).

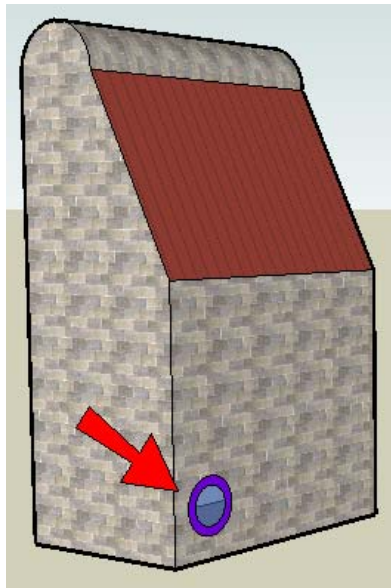


2. Pull the arc shape to the other side of the roof.

3. Then use **Move** on this edge, to make two sections of the tall wall. The lower half is vertical, the upper half is slightly sloped.



4. Paint the faces, and draw two concentric circles in this corner, to make the first window. (Remember to click the **Paint Bucket** tool to get the available colors and materials. Glass material is found in the folder called "Translucent.")

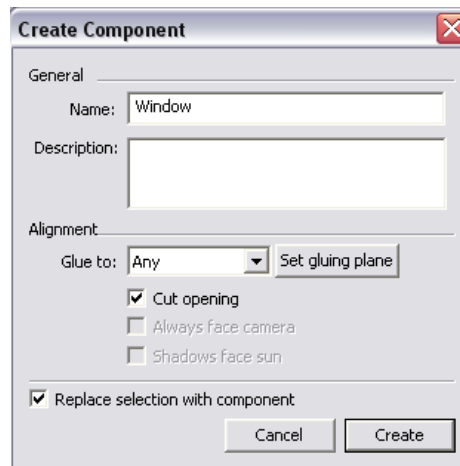


This window needs to be made into a component since we'll use it repeatedly. As a component, the window will be much easier to select - it acts as one object. (Components also have the advantage of being "unsticky" - it's much easier to move and rotate components without affecting objects they touch.)

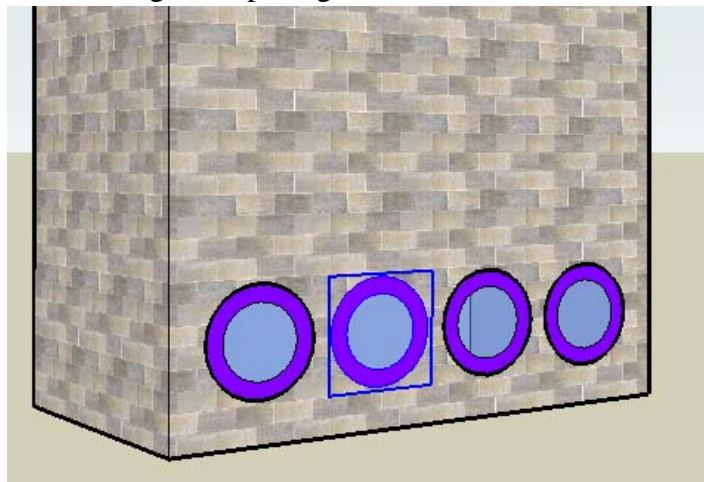
5. **Select** both faces of this window, and right-click on either of the faces. Choose **Make Component**.



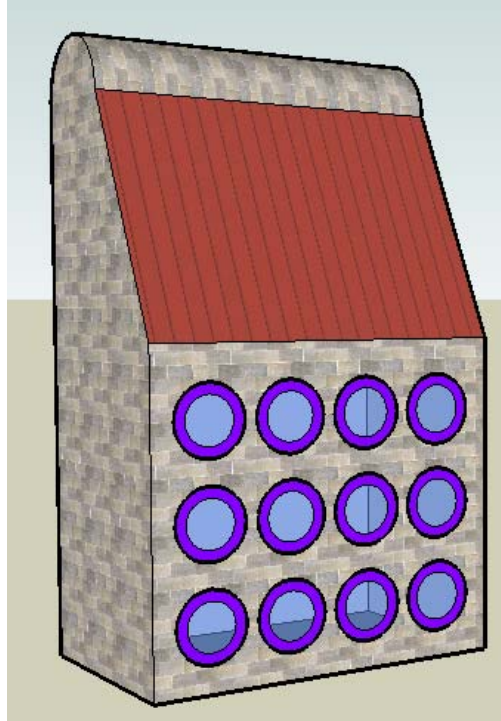
6. Give the component any name you want. Since it's a window, you want it to **Cut opening**, and also check **Replace selection with component**.



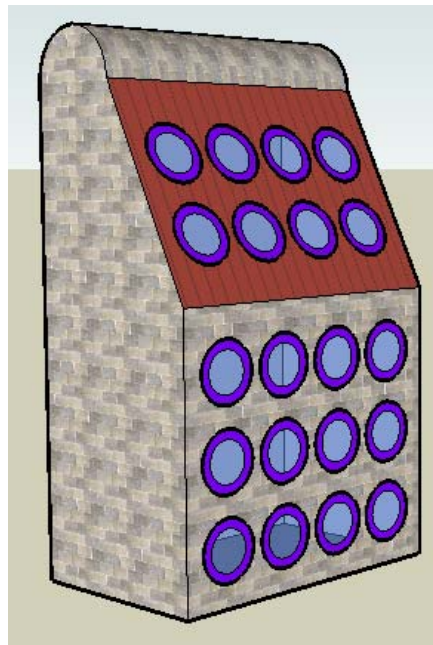
7. To add more windows, use the **Move** tool and press Ctrl / Option. After you place the first copy, type “3x” to make three copies. You can keep entering different numbers to get more or fewer windows. If you enter a value without the “x” you can change the spacing, which is also useful!



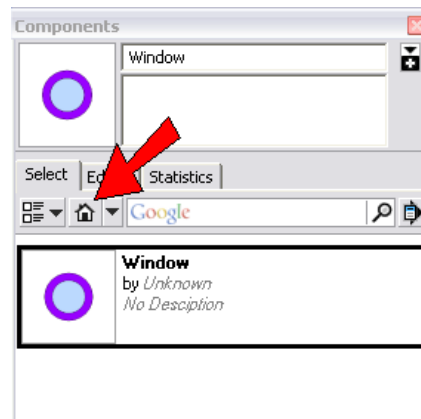
8. To make more rows in this wall, do the same thing: **Select** all of the windows in the first row, and make two or more copies of them, straight up.



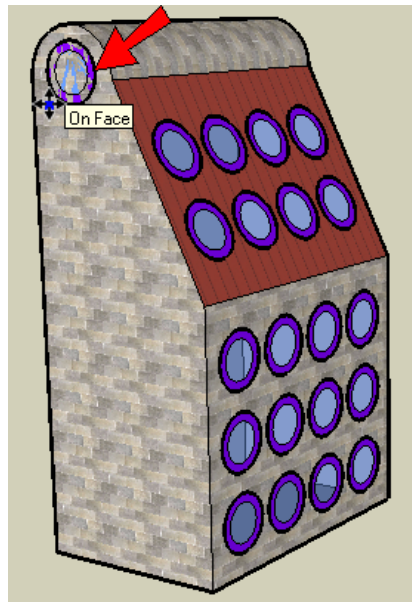
9. Copy some or all of the windows up to the sloped face. Even though the original windows make cutouts on the vertical wall, the new windows also cut the sloped wall.



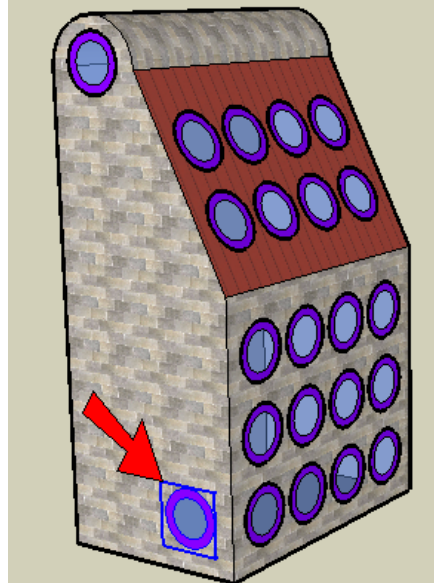
10. Another way to bring in a component is from the **Components** window (**Window / Components**). Click the house icon to see what's in your model so far. Click the thumbnail of the window, which is then attached to your cursor.



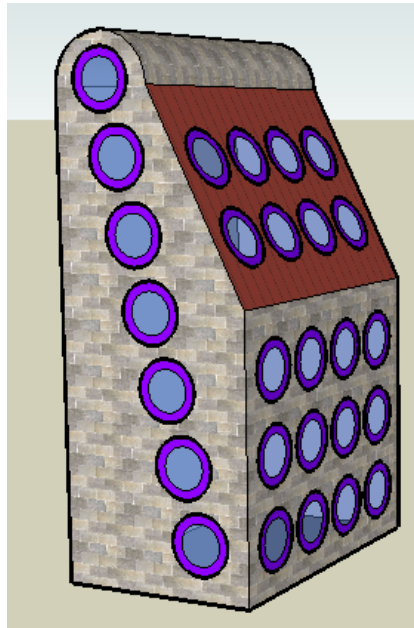
11. Place the window on this wall - it also cuts this face.



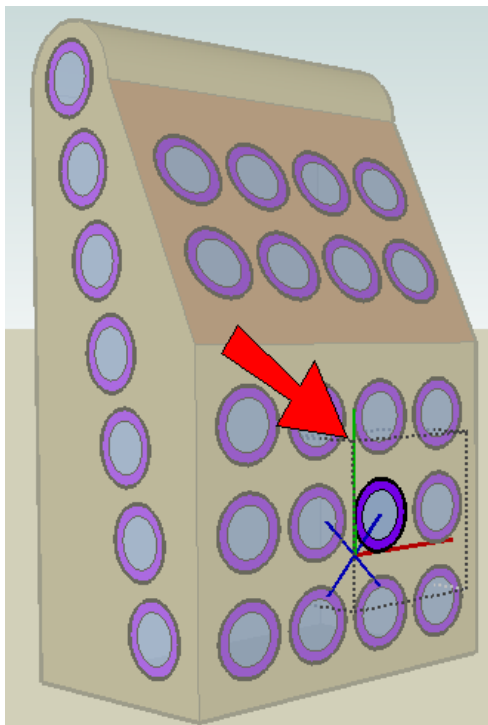
12. Here's another way to make copies. Copy that window you just added to the top, and place the copy at the bottom, near the front.



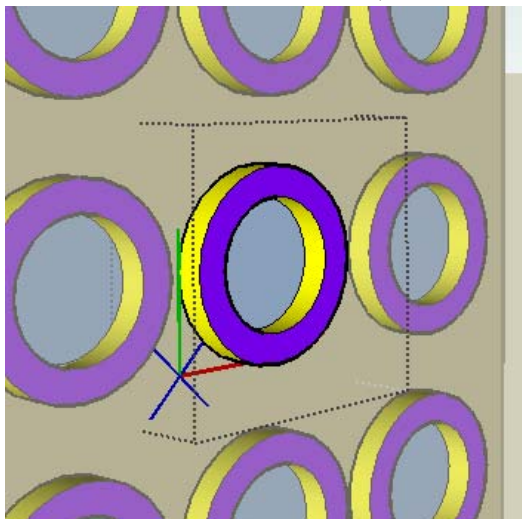
13. Enter “6/” (with a slash symbol), and you get seven copies including the first and last windows.



14. Here's the great feature of components: you change one, and you change them all. But you need to "open" a component before you can make any changes to it. The easiest way to edit a component is to activate **Select** and double-click it. Do this for any window - they're all the same. You'll see the one you're editing outlined in a dashed box, and everything else is faded.

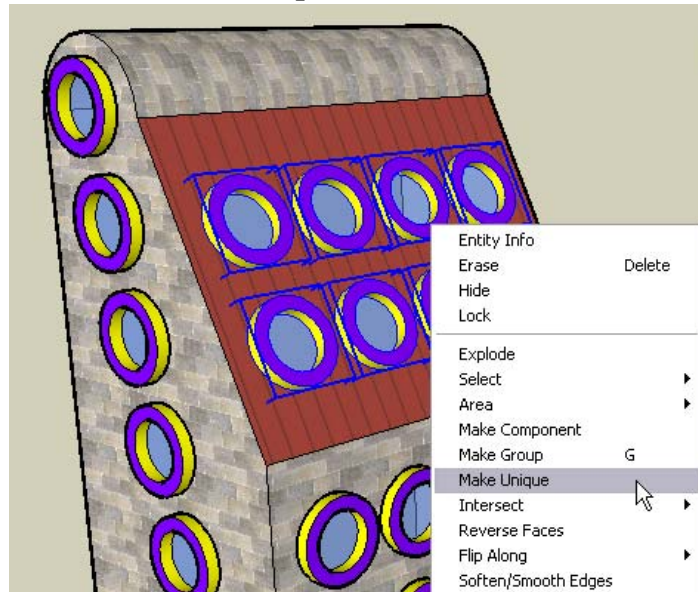


15. Use **Push/Pull** to make the outer circle into a window frame, and add some more colors.

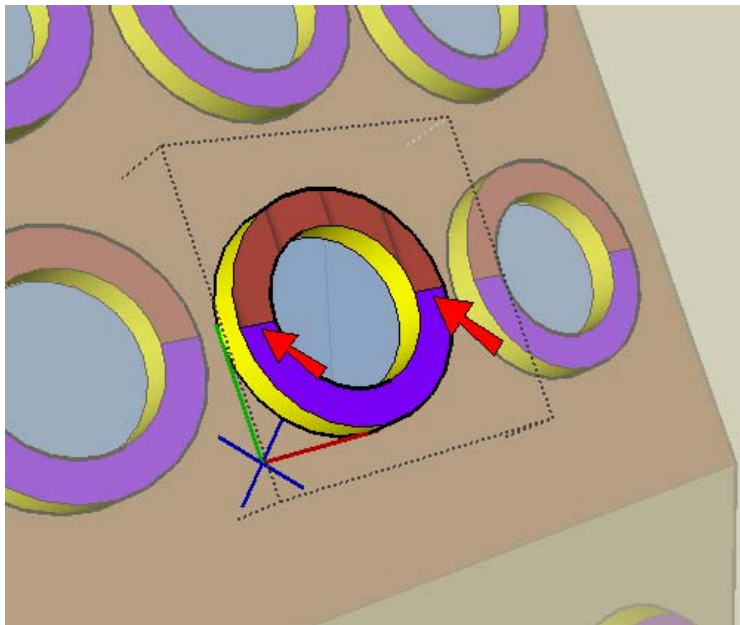


16. When you're done, close the component by activating **Select** and clicking outside the component.

17. What if you want some of the windows to be different? For instance, I want all the windows on the sloped face to have a shade cover. Select the components you want to make different (all the ones on the sloped face), and right-click on one of them. Choose **Make Unique**.

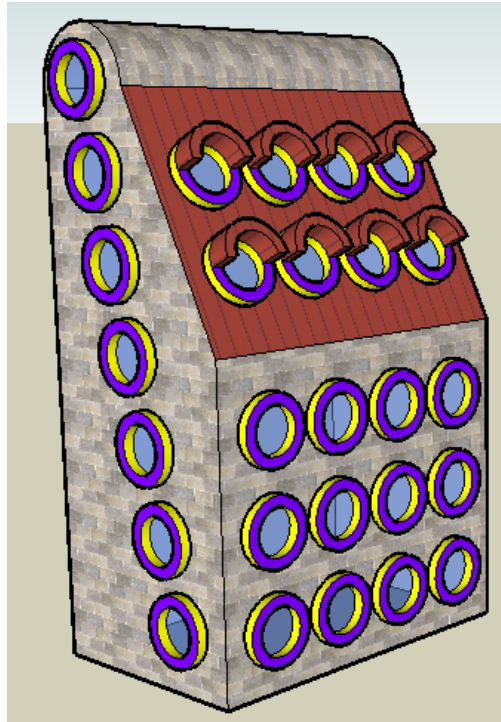


18. Now edit one of the “unique” windows. For my cover, I added two lines to the front face, and colored the top part the same as I painted the roof.

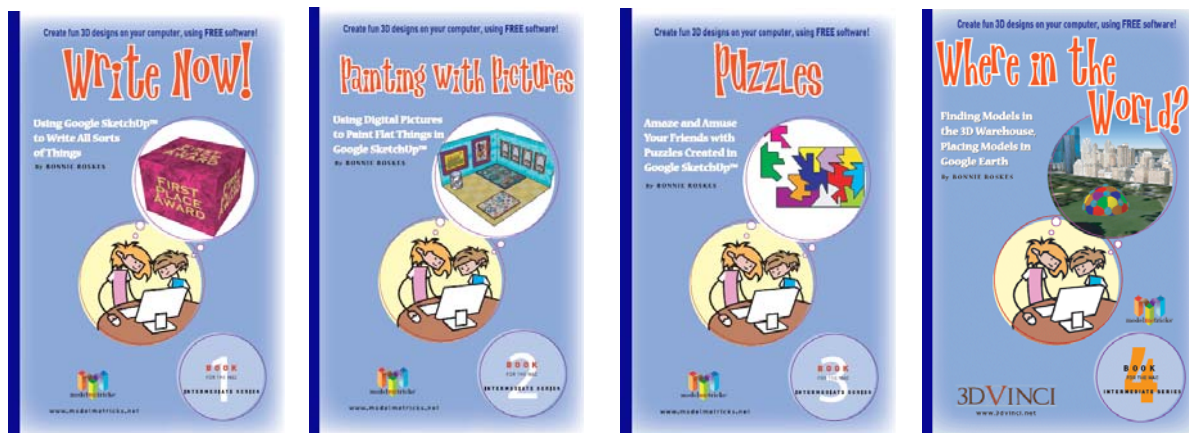


19. To make the cover, use **Push/Pull** but press the Ctrl / Option key. This way you’ll be adding a new part, instead of pulling out an existing face.

When you're done, you should have something like this:



If you like this project, please check out 3DVinci's ModelMetrics Intermediate Series (http://www.3dvinci.net/ccp0-prodshow/MIB_PDF.html). For this age group, once students have the basic tools mastered, they can enjoy projects like puzzles, 3D Text, working with digital images, and integrating models into Google Earth.



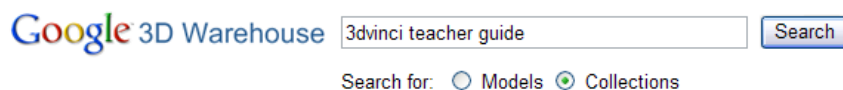
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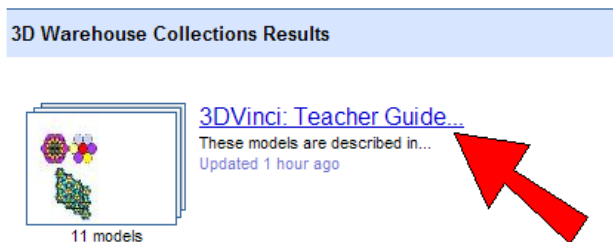
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Google SketchUp Design Project: Grades 10 - 12



This advanced design project uses many of SketchUp's drawing tools, and involves paying some attention to the exact sizes of what you're drawing. You'll also make good use of components. The final result: a dream bedroom, complete with furniture and a swimming pool.

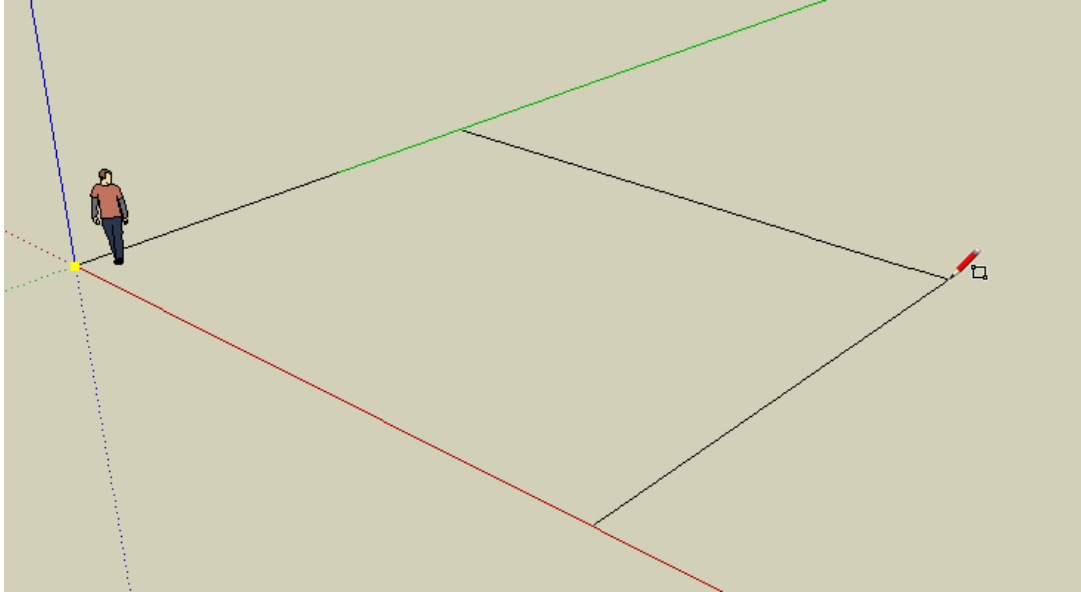
Once you understand how this room is built and furnished, the concept can be applied to anything - a dream classroom, dream rec room, dream bathroom, dream gym, etc. It's a very fun project; kids really get to exercise their creativity designing and furnishing spaces they'd like to live in!

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The Mac version is at www.3dvinci.net/SketchUp_Intro_Mac.pdf.

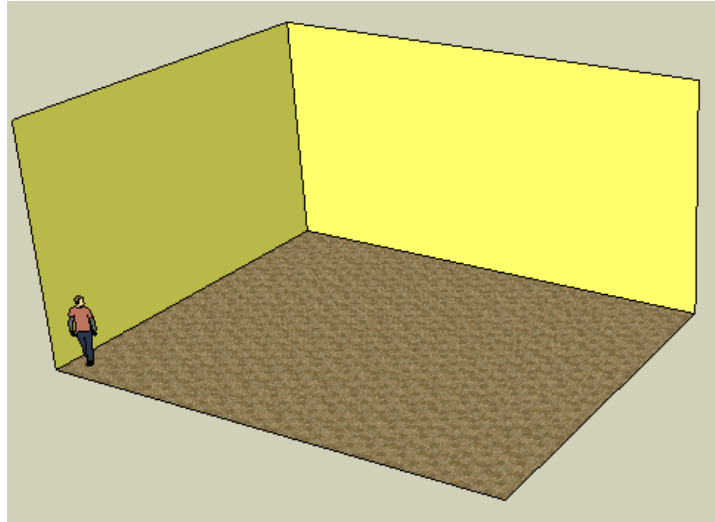
1. This bedroom will be pretty big, so leave the person in the file as a basis for size. Make a rectangle for the basic room shape, but don't click to finish it yet.



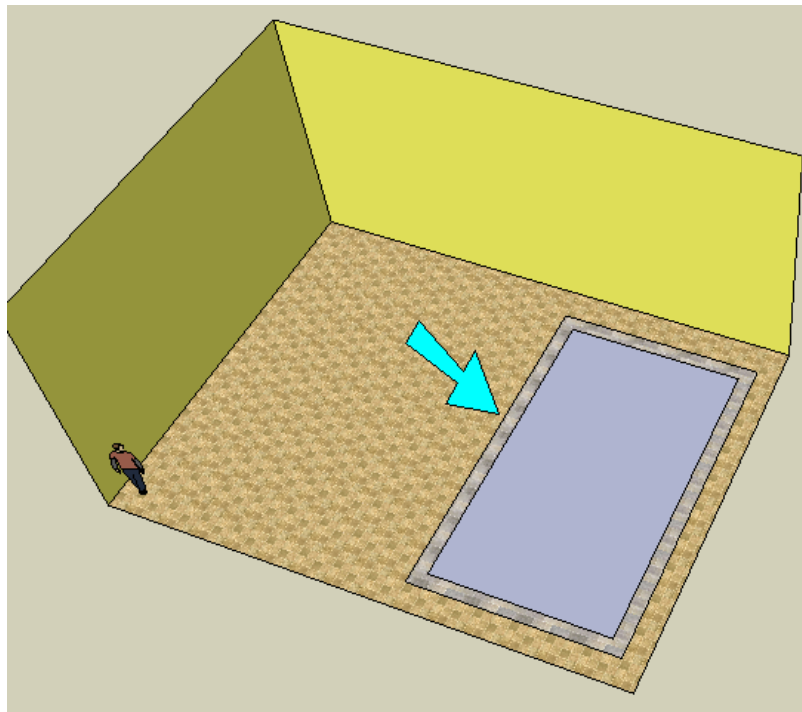
2. Many of SketchUp's tools can use exact numbers. While you're using the **Rectangle** tool, look at the **Dimensions** box below the SketchUp window. You'll see the length and width of the rectangle change while you move the mouse. Make this rectangle about 30 feet wide and 40 feet long. (If you want the numbers to be exact, you can type them in and press Enter. Be sure to include the apostrophe foot symbol, and separate the two numbers with a comma.)

Dimensions 40' 5", 30' 3 3/4"

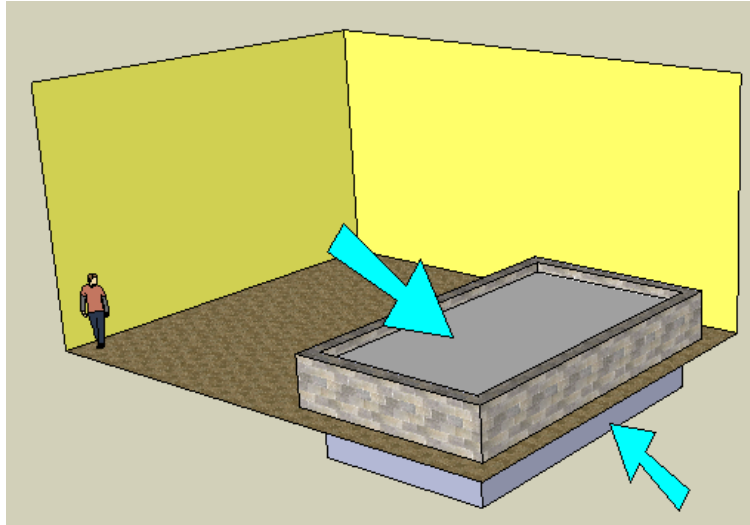
3. The bedroom will be a loft (it has two levels), so pull the rectangle up about 20 feet. Erase edges so that the ceiling and two walls disappear, enabling you to see inside.



4. About half of the lower level will be filled with a swimming pool (because no bedroom is complete without one). Use **Rectangle** to make the shape. To make the outline, you can make another rectangle, or use the **Offset** tool.

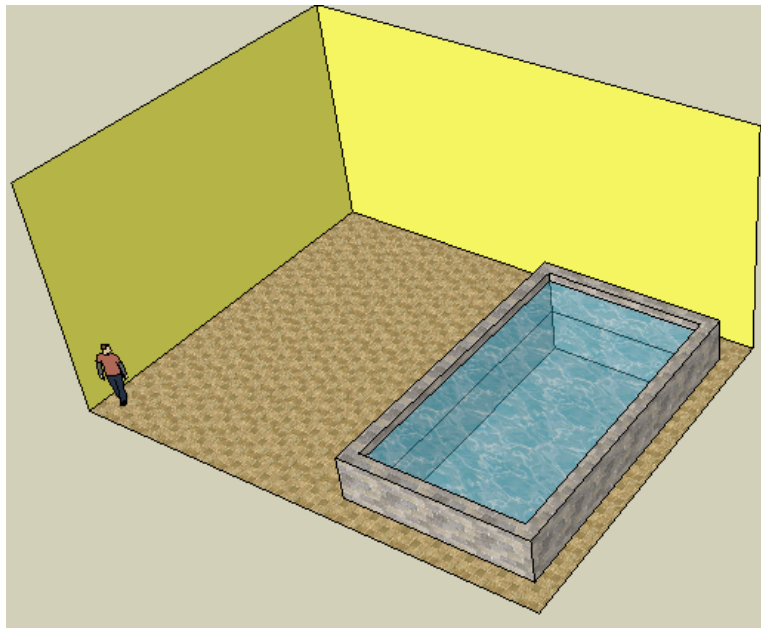


5. Pull up the pool walls, and pull up the floor to make the water line. When you use **Push/Pull** for this, keep the Ctrl / Option key pressed. This means that the bedroom floor will stay intact, instead of being “sucked up” with the pool objects. (Try it first without the Ctrl / Option key to see the difference). If the water doesn’t seem deep enough, pull the bedroom floor down (*without* the Ctrl / Option key).

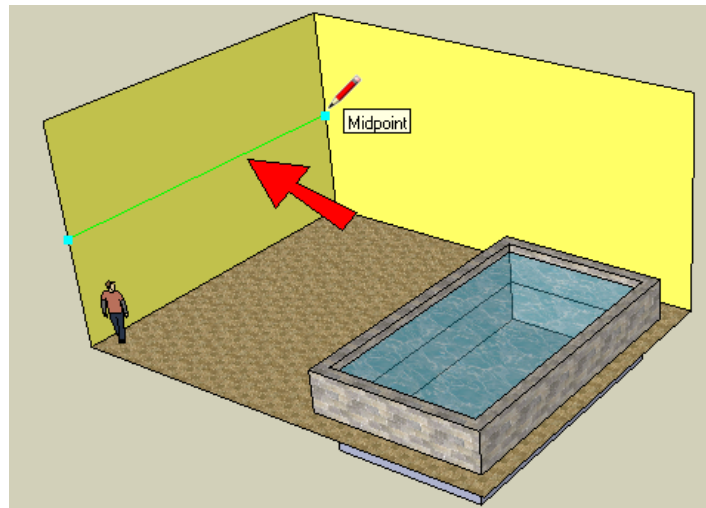


Yes, it looks weird to have a pool sticking out below the floor. But at the end, you can place a large square of grass or concrete around the room, which will hide the bottom of the pool.

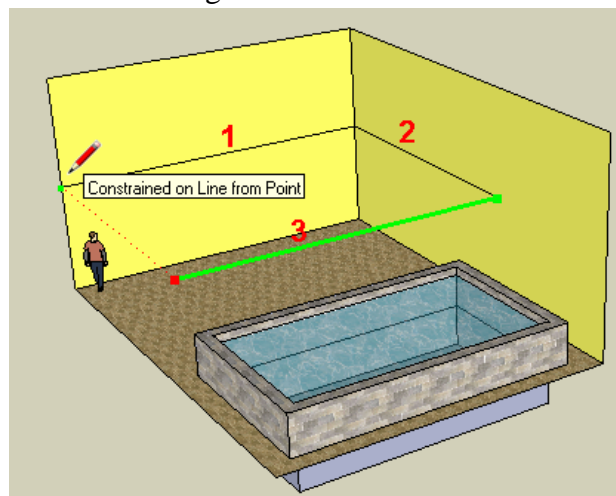
6. There is a “Water” folder for materials, which contains one translucent water material. Use this for the face of the water line, and you can see through to the bottom of the pool.



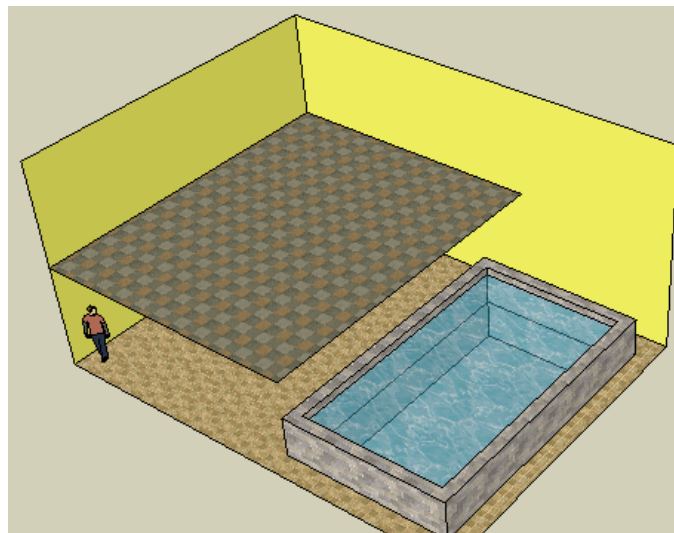
7. Now we can make the loft floor. It will be a simple rectangle which extends as far as the pool below. Start with a line along one wall like this:



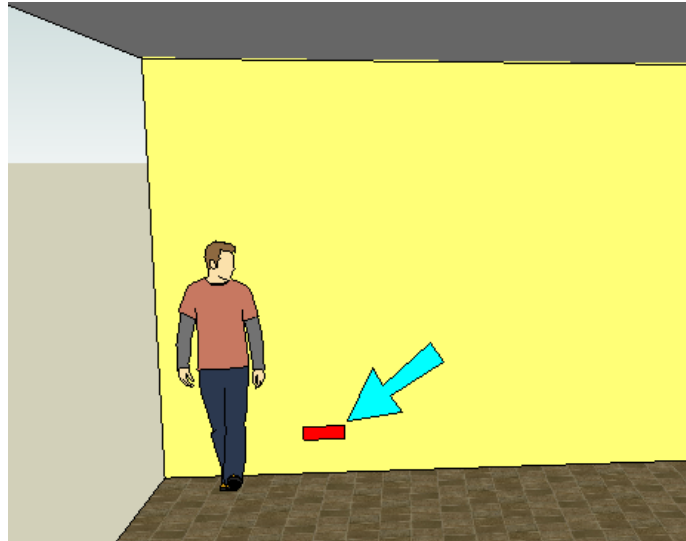
8. Make the floor long enough to hang a little over the pool (Line 2). When you make Line 3, start drawing in the direction you want the line to go (green, in my example). Press Shift to “lock” the direction, and click the first point of Line 1. This sets the exact length of Line 3.



9. Complete the last line to finish the loft floor.



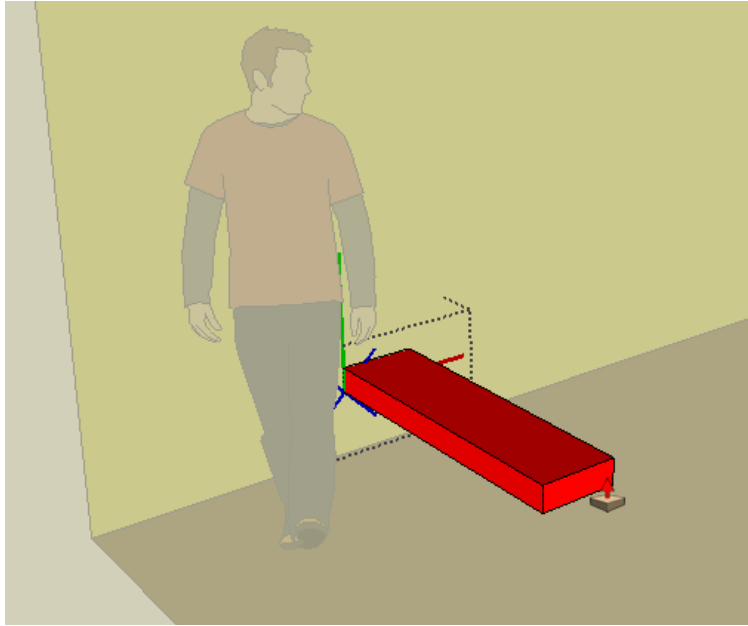
10. Now we need steps to get up to the loft. Steps are MUCH easier when you use components. Start with a small rectangle along the wall, for the first step. (If you're using exact numbers, it should be about 12" x 2".)



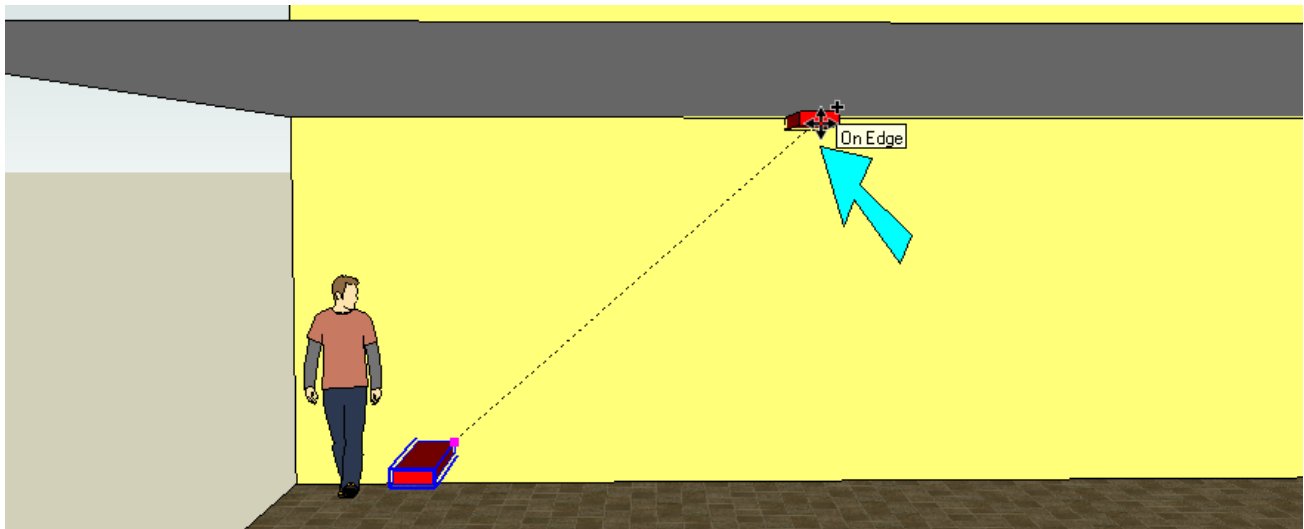
11. **Select** this small face plus its edges and make it a component.



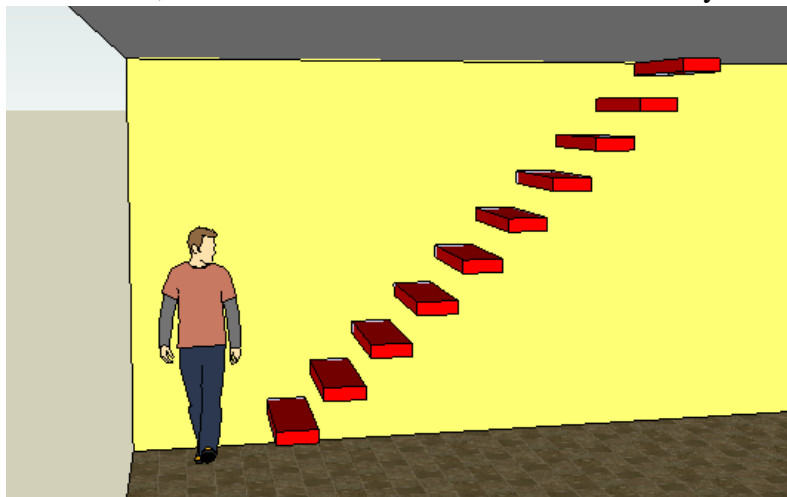
12. Edit the component, and pull the step out about 4 feet.



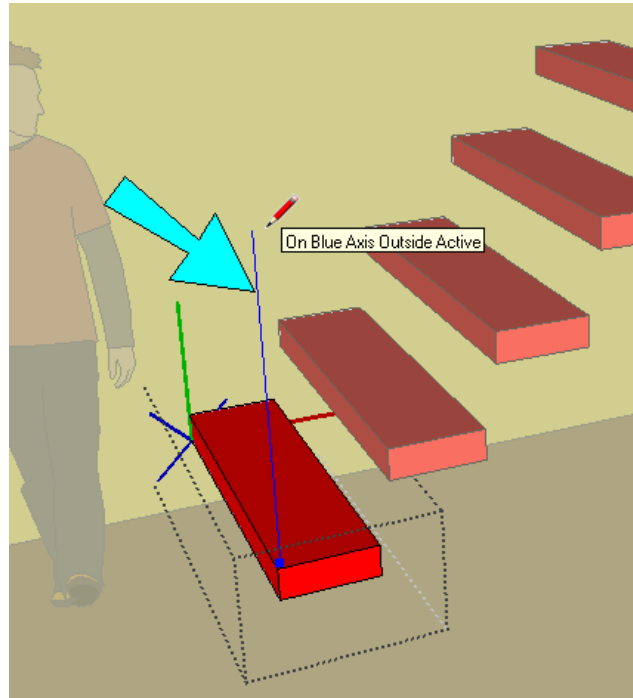
13. Close the component, and then make one copy at the top of the loft floor.



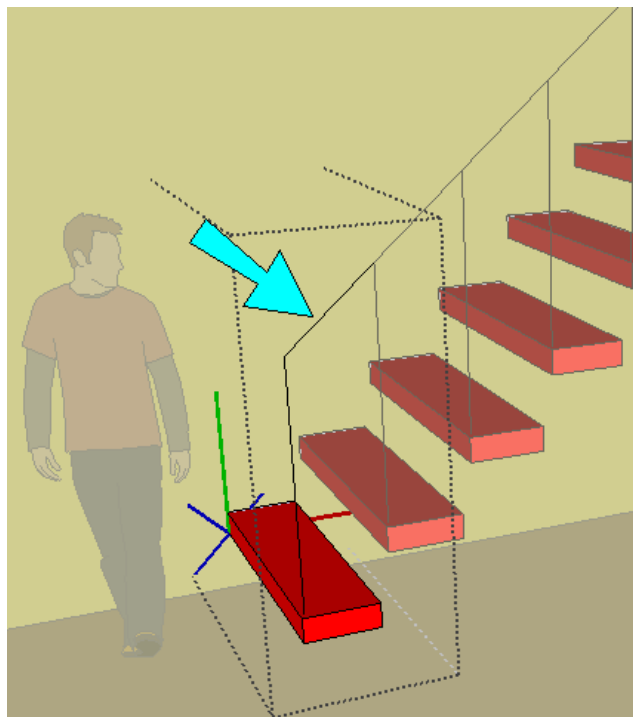
14. To make all the steps in between, enter "9" or whatever number works for you.



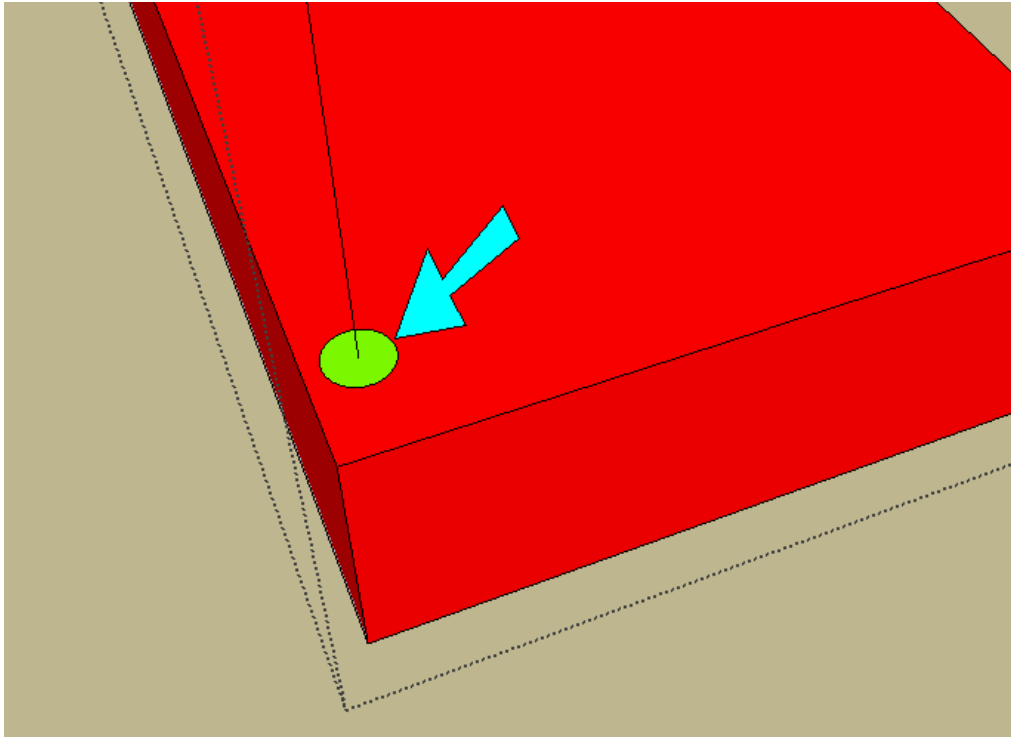
15. Components are also great for making railings. Edit any step, and draw a vertical (blue) line in the lower corner, about 3 feet high.



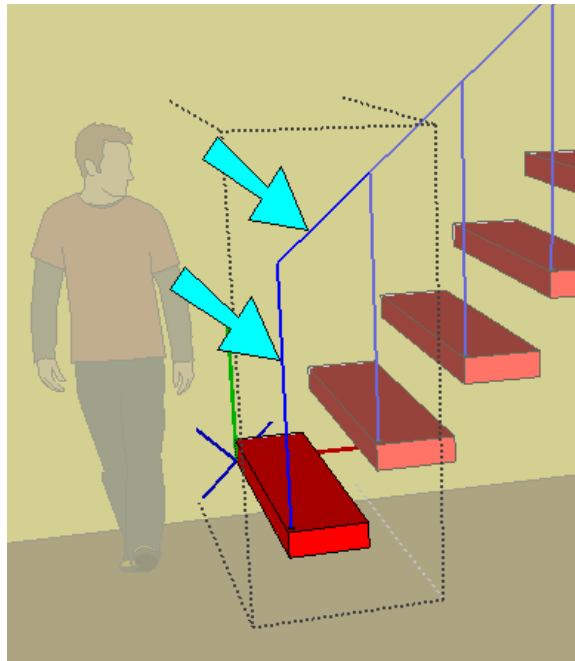
16. Then add a line connecting one vertical line to the next.



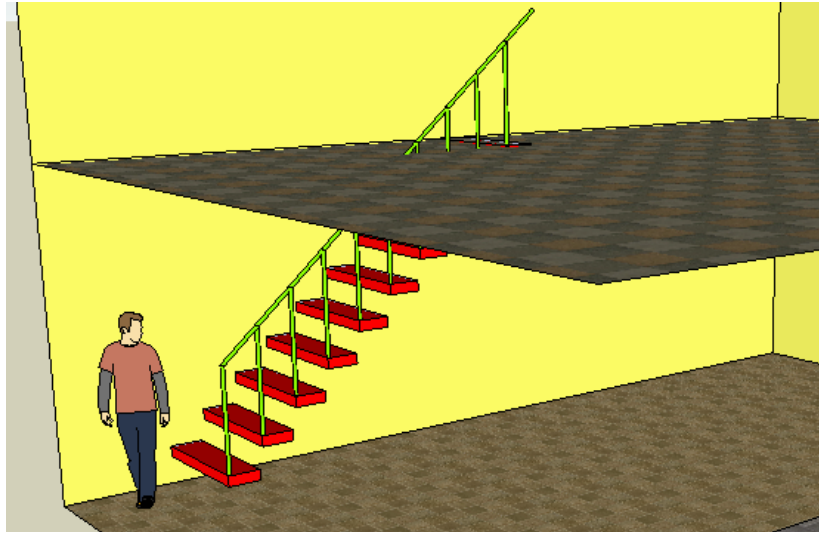
17. At the base of the vertical line, make a small circle.



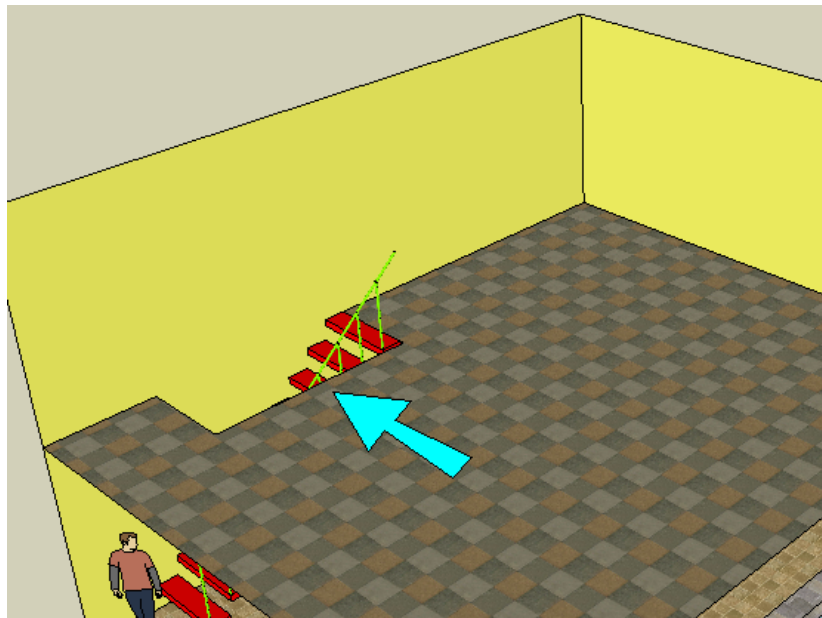
18. **Select** both of the lines you made before.



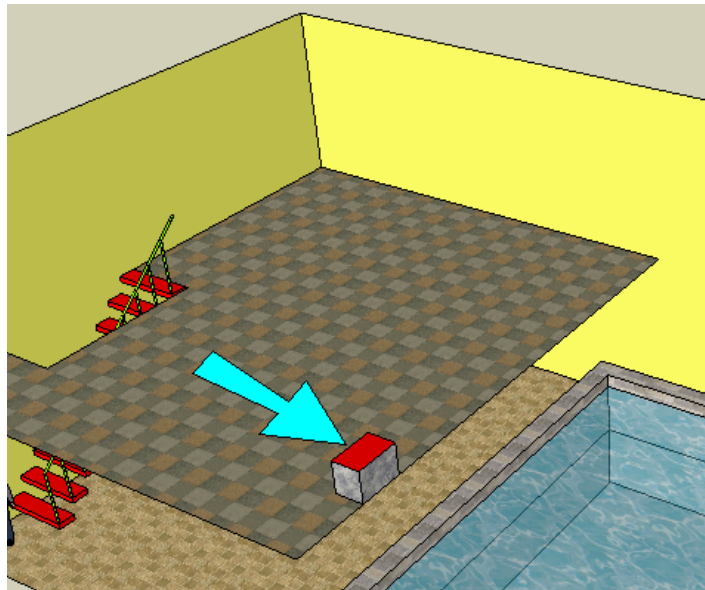
19. Activate **Follow Me** (**Tools / Follow Me**) and click the circle. The circle is pushed along the vertical and diagonal lines, creating a railing at every step.



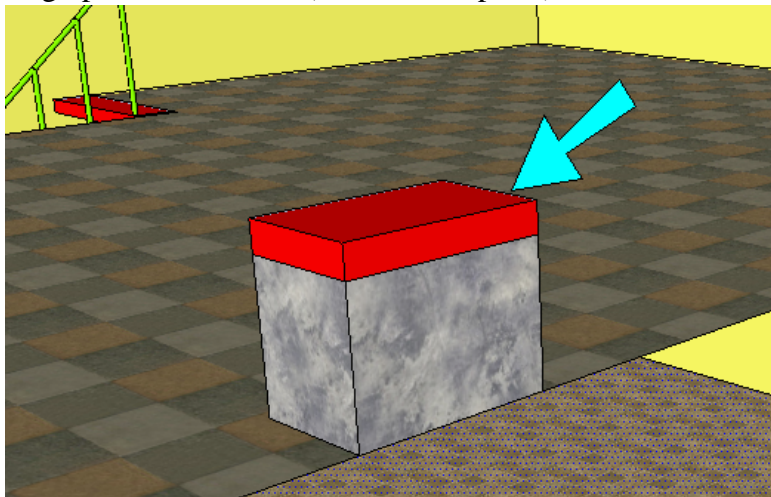
20. We want to go up the steps without hitting our heads on the floor above, so cut a hole out of the loft floor.



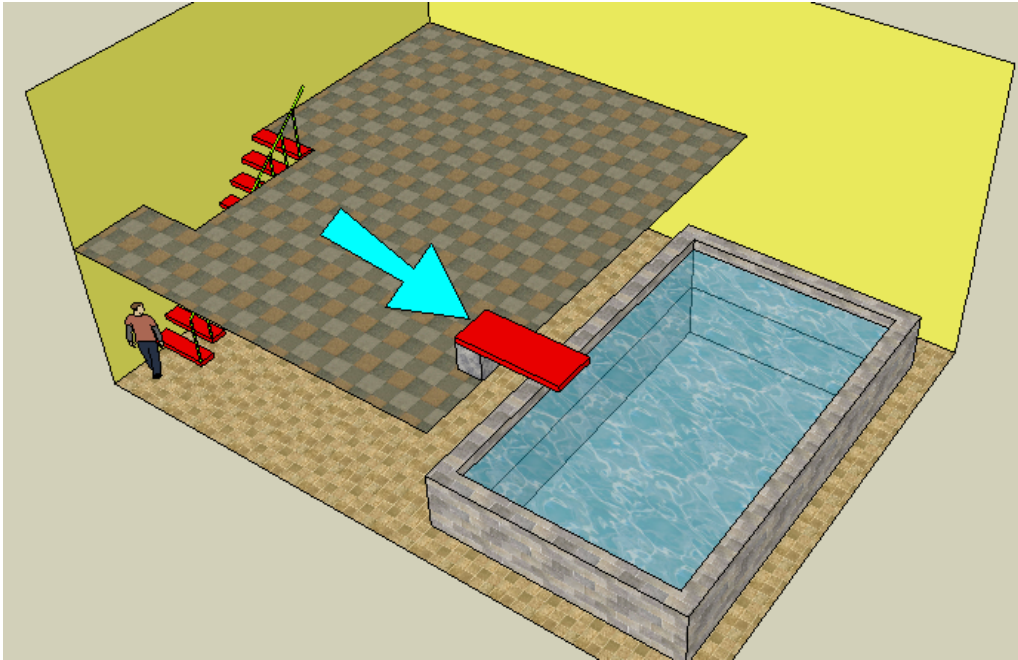
21. If you're too lazy to go down the steps to take a dip, you'll want a diving board on the loft level. Make a block like this (remember to press Ctrl / Option when you use **Push/Pull**) and paint the top the color you want to use for the board.



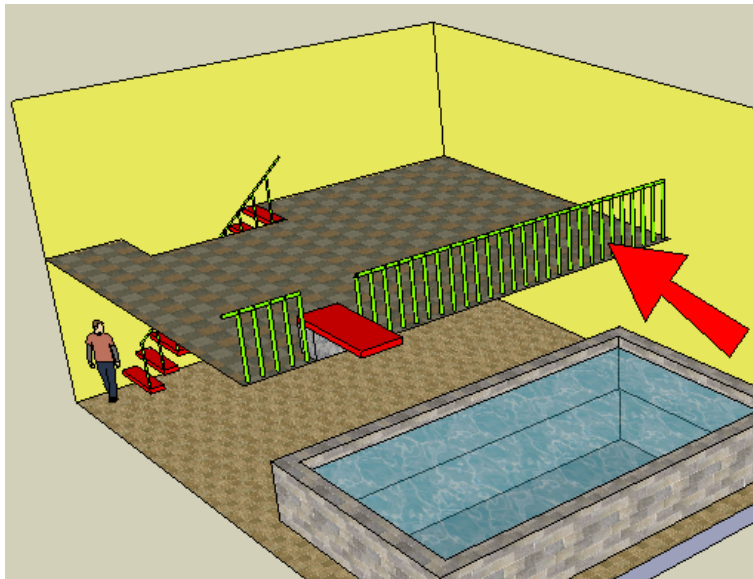
22. Start the board by pulling up a little like this (with Ctrl / Option):



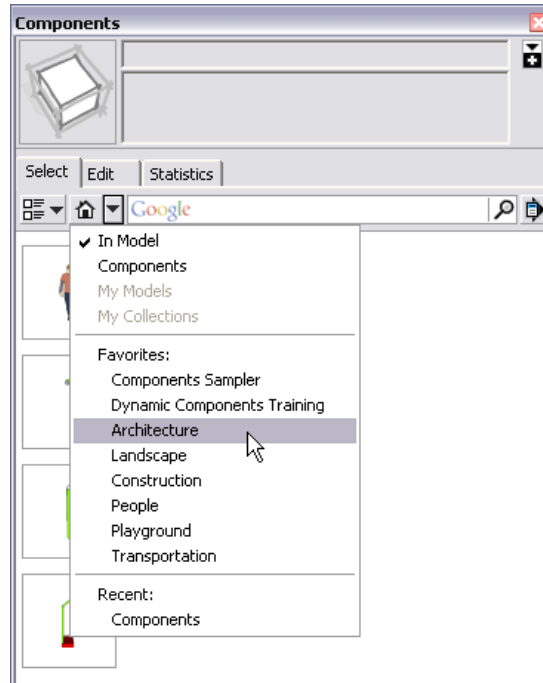
23. And pull the board out, making sure it hangs over the pool.



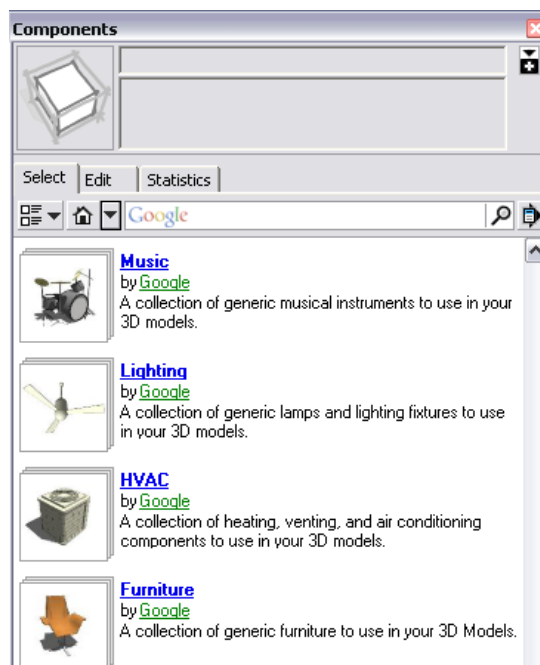
24. If you don't want to roll out of bed and fall into the pool, use components and **Follow Me** to make a railing.



25. For the rest of the furniture, we'll use some models provided by Google. In the Components window, click the drop-down arrow next to the house icon, and choose **Architecture**.

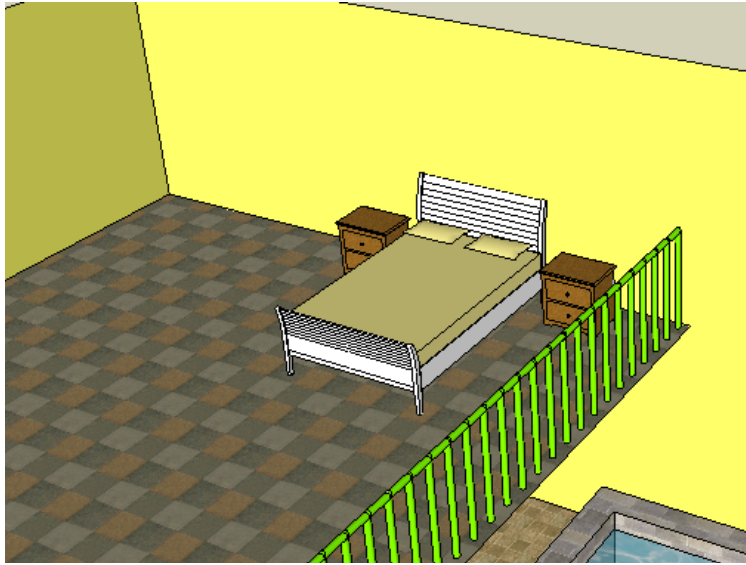


26. The “Architecture” collection contains other collections of objects like windows, plumbing, lighting, and games. Clicking the thumbnail of a collection will open the collection within the Components window. Clicking the collection name will open the collection in your Internet browser. When you open a collection and find a model you want to bring into your room, click the model’s thumbnail, and the model can be dragged right into the model.

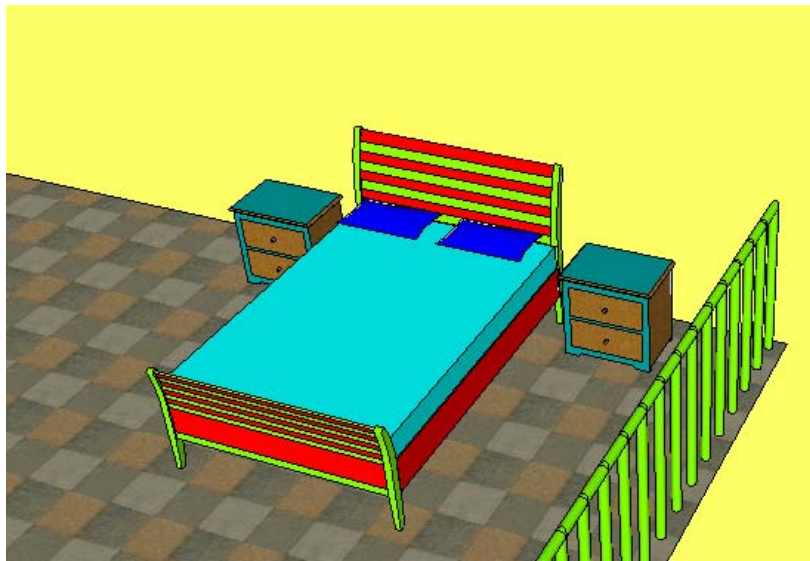


The collections you open this way contain basic, generic, models that have the correct dimensions and are modeled properly. To find other models, you can use the Search field in the Components window. But keep in mind that some models in the 3D Warehouse don't have the correct scale, and the quality is not guaranteed.

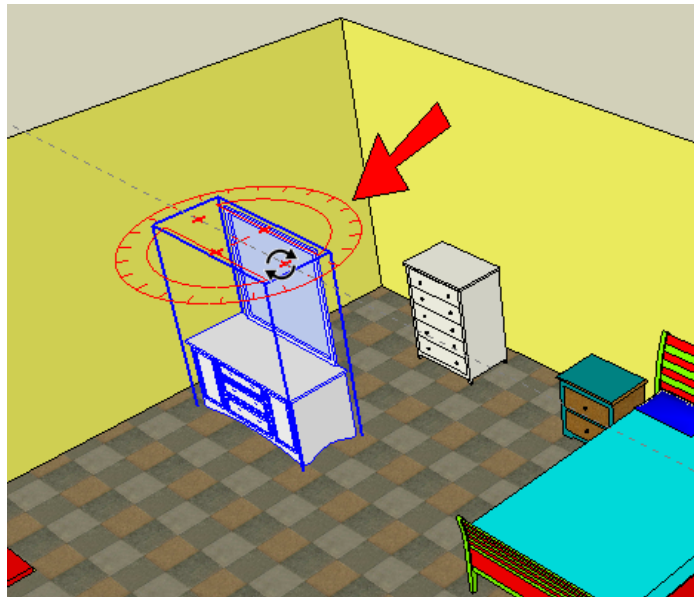
27. Fill both levels of the bedroom however you want. For example, the “Architecture” collection contains collections for beds and dressers.



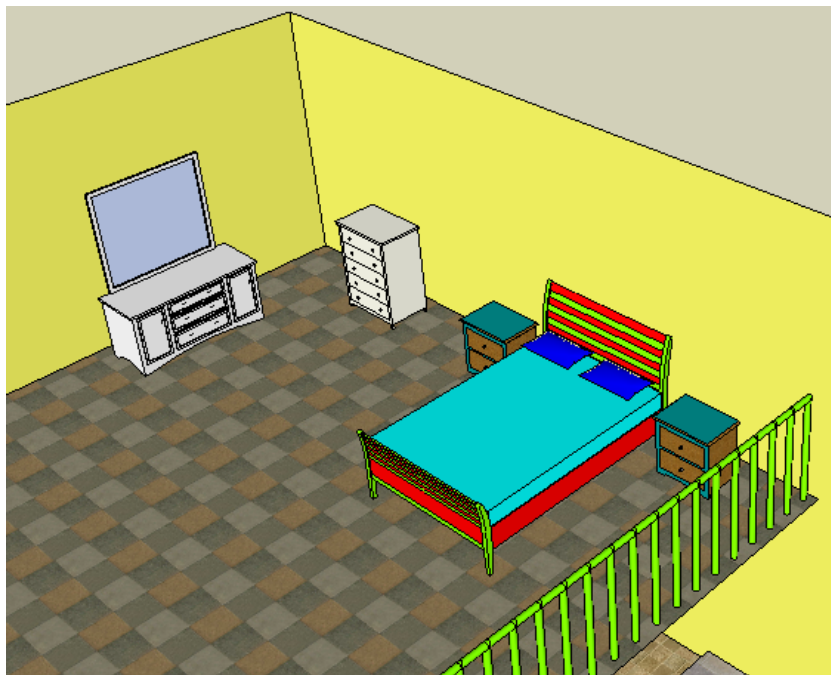
28. If you want to change any of these components, just edit them. For example, I changed the colors of the bed and tables.



29. When you drag in a component from the **Components** window, the active tool is **Move** so that you can place the component and slide it around. If you place your cursor over one of the red “plus” signs, you can also **Rotate** your component, like the dresser below:



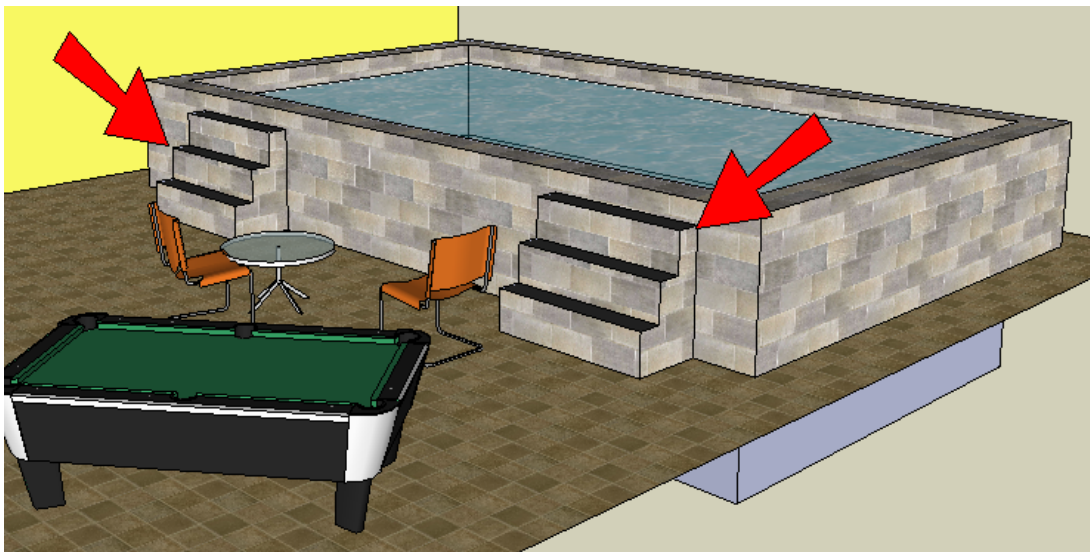
This is how my bedroom furniture looks:



30. Here's what I put downstairs, including a fridge from the "Appliances" collection, a flat-screen TV from "Electronics," and a pool table from "Games."



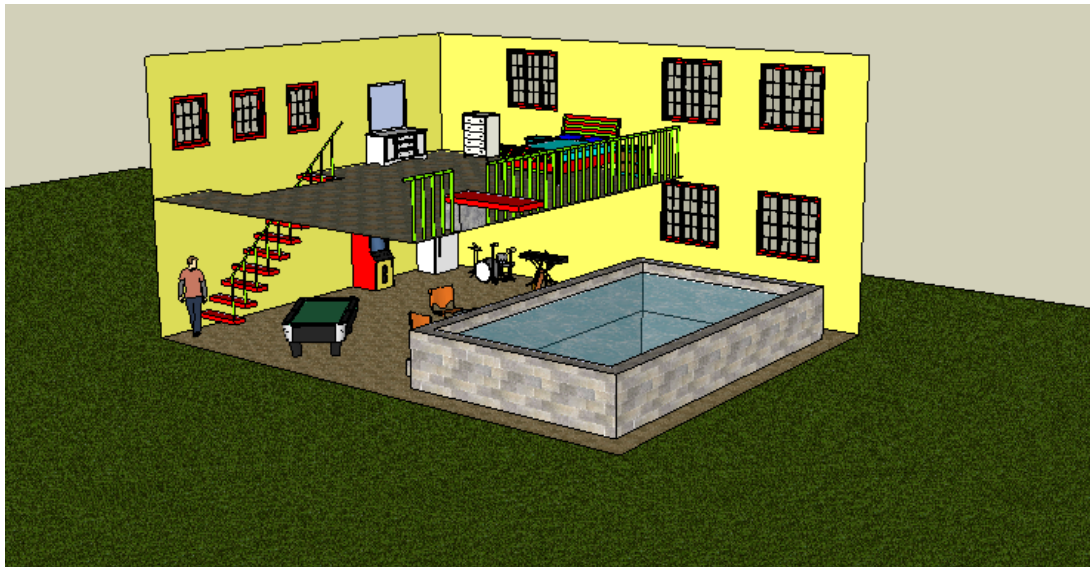
31. And don't forget steps to get up to the pool.



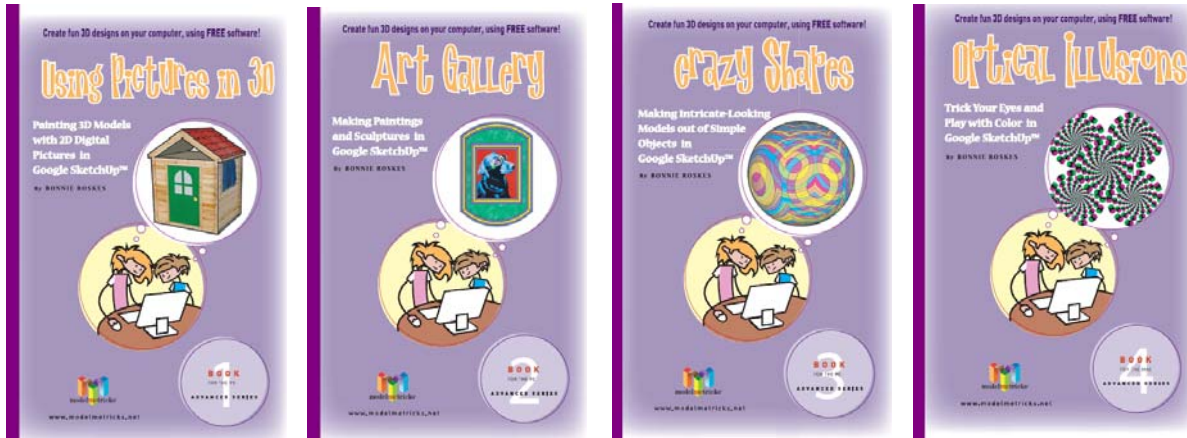
32. Finish up by adding some windows.



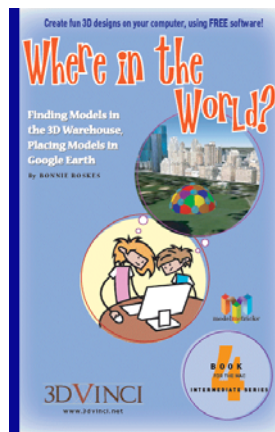
33. If you want to hide the bottom of the pool, add a large patch of grass on the ground (the material is in the “Vegetation” folder).



If you like this project, please check out 3DVinci's ModelMetrics Advanced Series (http://www.3dvinci.net/ccp0-prodshow/MAB_PDF.html). This age group is capable of creating quite complex models, and making use of geometric concepts, digital images, and sophisticated color usage.



And the book Where in the World? (http://www.3dvinci.net/ccp0-prodshow/MI4_PDF.html) will show you how to find the exact model you're looking for, in Google's 3D Warehouse.



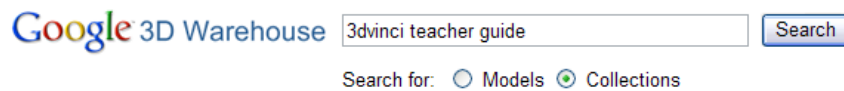
And if you want to receive three ready-to-use projects like these each month, sign up for our SketchUp Projects of the Month subscription (<http://www.3dvinci.net/ccp0-prodshow/POM.html>).

All of the models in the Teacher Guide can be downloaded from Google's 3D Warehouse:
<http://sketchup.google.com/3dwarehouse>.

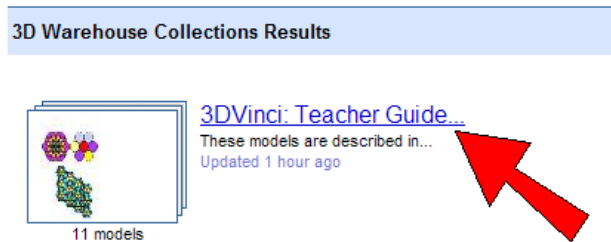
- Click [this link](#) to see the entire Warehouse collection of models used in the Teacher Guide.
- Click [this link](#) to locate this exact bedroom model in the Warehouse.

If you're reading this as a printed PDF and can't click on the links, here's how to find the Teacher Guide models:

1. Open the 3D Warehouse.
2. In the **Search** field, type "3dvinci teacher guide" and click **Collections**. Then press Enter or click the **Search** button.



3. Open this link:



4. In the collection, find the model you want, and open or download it.

Google SketchUp Math Project: Grades 1 - 5



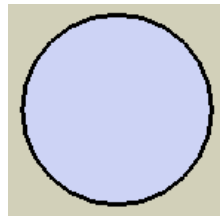
In this project, you will create some interesting patterns, starting with just a basic circle. The number six is used everywhere.

If you need some basic information on downloading Google SketchUp, or about its user interface and basic tools, please see our printable "Intro to SketchUp" PDF.

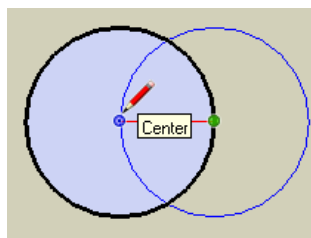
The PC version is at www.3dvinci.net/SketchUp_Intro_PC.pdf.

The Mac version is at www.3dvinci.net/SketchUp_Intro_Mac.pdf.

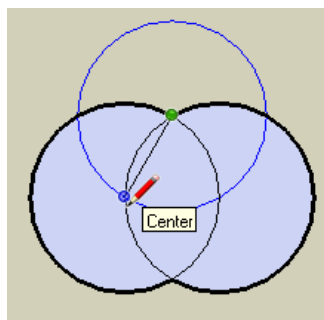
1. This project is all done in **Top** view (**Camera / Standard Views / Top**). You will automatically open SketchUp in top view if you choose one of the "plan view" templates at startup.
2. Draw a circle.



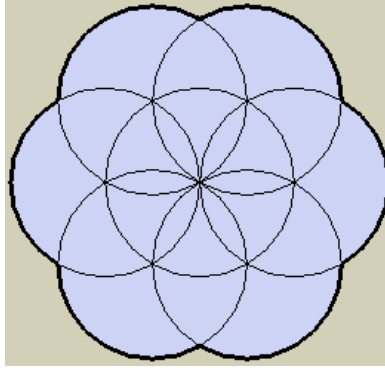
3. Make the second circle like this: with its center at a circumference point on the first circle, and ending at the center of the first circle.



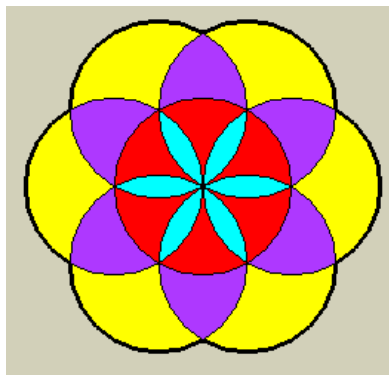
4. Make the third circle like this: with its center at the intersection of the first two circles, and ending at the center of the first circle.



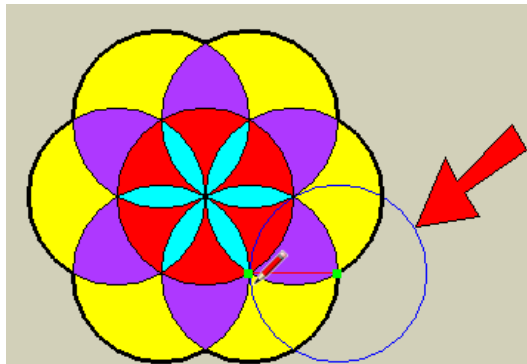
5. Keep making circles like that last one, until you have six circles surrounding the center one.



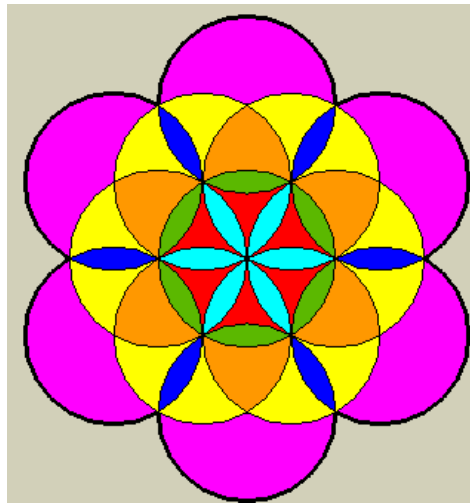
6. Click the **Paint Bucket** tool to open the **Materials** window (**Colors** on the Mac), and paint the faces in a pattern.



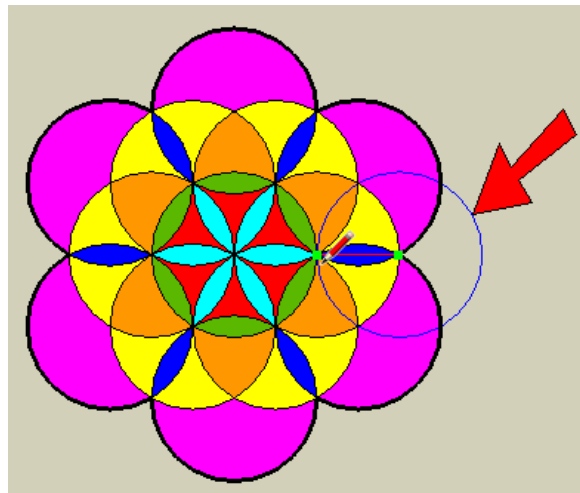
7. To start the next set of circles, make the first circle using these points.



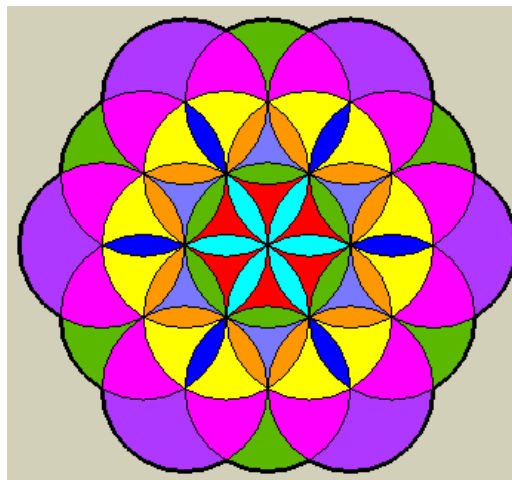
8. Again, there are six circles that fill the pattern all the way around. And all of the circles are the same size. Color the faces.



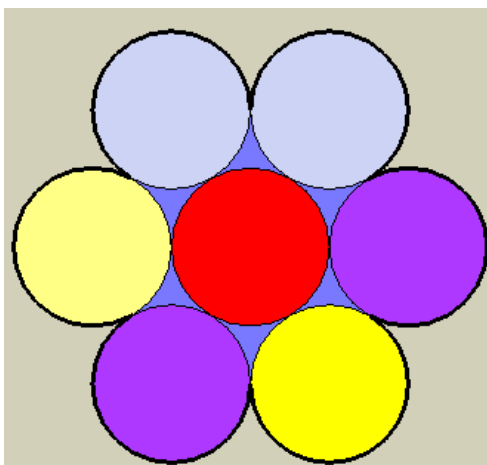
9. One more set of circles! Start with this one:



10. And make the same circle all the way around (again, there are six).

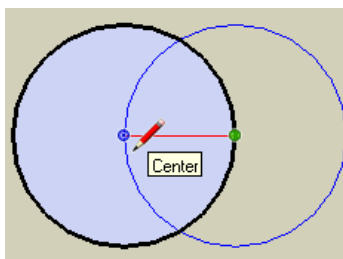


11. Here's something neat about this pattern. If you use the **Eraser** tool to remove some of the inside edges, you can get this pattern: one circle with six identical circles around it. (You can try this with coins or cups, too.)

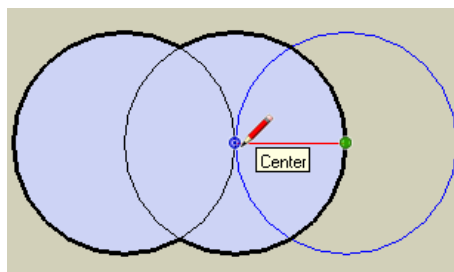


Here's another way circles are related to the number six.

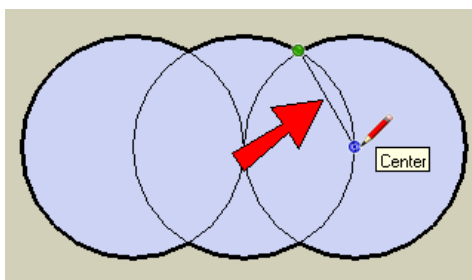
1. In the same SketchUp file, or in a new one, draw a circle. Then draw a second circle like this:



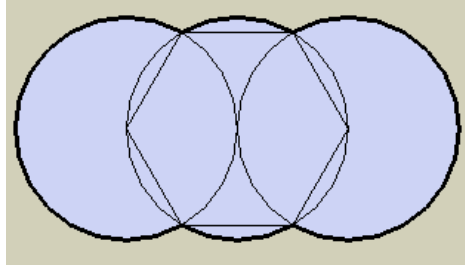
2. Then make a third circle like this:



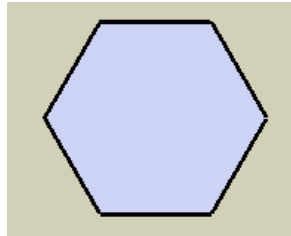
3. Click the **Line** tool, and draw this line, from the center of the third circle, to the point where it meets the second circle.



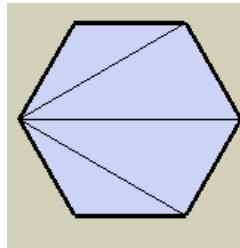
4. Make five more lines within the middle circle.



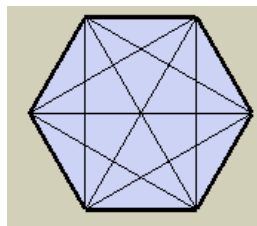
5. Erase all of the circle, and you're left with a perfect hexagon.



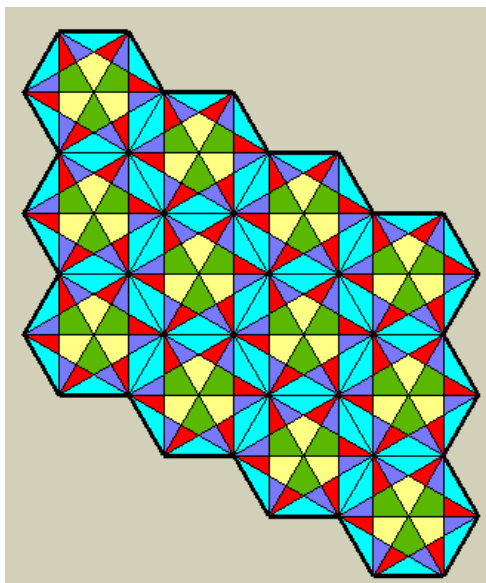
6. Hexagons can also be used to make great patterns. From one corner, draw three lines to the other corners.



7. Make similar lines from other corners.

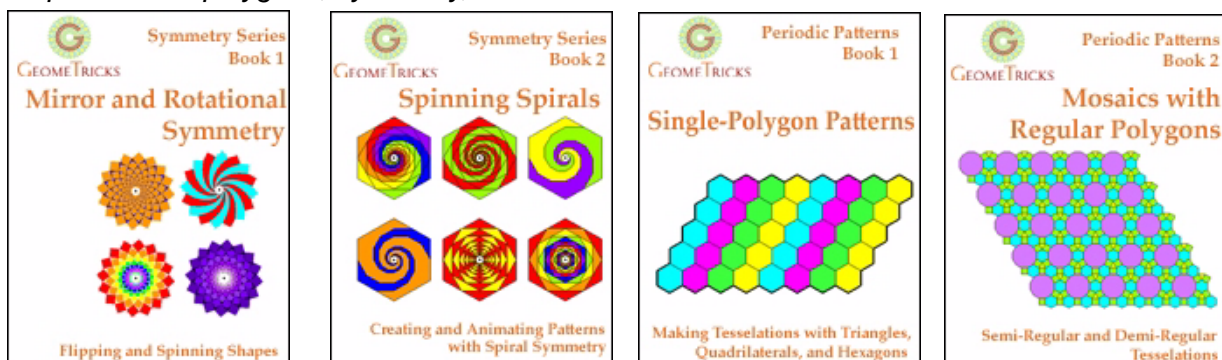


8. Color the faces inside the hexagon however you like. Hexagons tessellate perfectly - we can make several rows of them with no gaps. (The **Move** tool is used to make copies, just press the Ctrl/Option key.) So you can start with just one circle, and get an entire mosaic!



In addition to using SketchUp to teach math, it's also a great tool in art class!

If you like this project, please check out 3DVinci's *GeomeTricks Series* (<http://www.3dvinci.net/ccp0-catshow/GM.html>). The books shown below are appropriate for this age group, and teach concepts such as polygons, symmetry, and tessellation.



And if you want to receive three ready-to-use projects like these each month, sign up for our SketchUp Projects of the Month subscription (<http://www.3dvinci.net/ccp0-prodshow/POM.html>). Each month, you'll get one project related to geometry, and two projects that teach a 3D design concept.

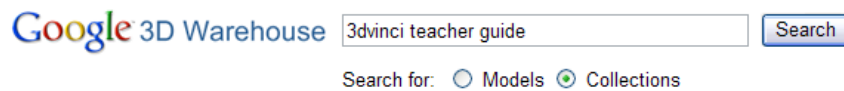
Also, be sure to check out our free geometry projects at www.mathforum.org/sketchup/

All of the models in the Teacher Guide can be downloaded from Google's 3D Warehouse:
<http://sketchup.google.com/3dwarehouse>.

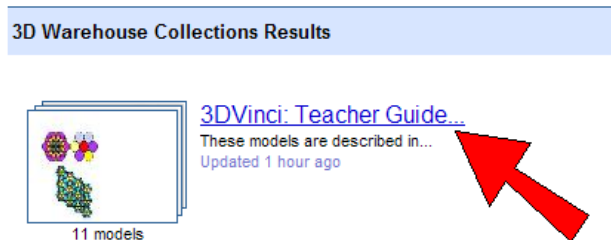
- Click [this link](#) to see the entire Warehouse collection of models used in the Teacher Guide.
- Click [this link](#) to locate this exact circle model in the Warehouse.

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3. Open this link:



4. In the collection, find the model you want, and open or download it.

Google SketchUp

Math Project:

Grades 6 - 9



This is a fun project because it involves making 3D shapes in SketchUp, and also in “real life” with folded paper.

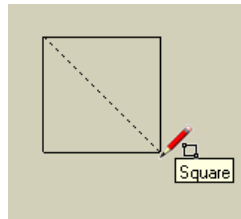
If you need some basic information on downloading Google SketchUp, or about its user interface and basic tools, please see our printable “Intro to SketchUp” PDF.

The PC version is at www.3dvinci.net/SketchUp_Intro_PC.pdf.

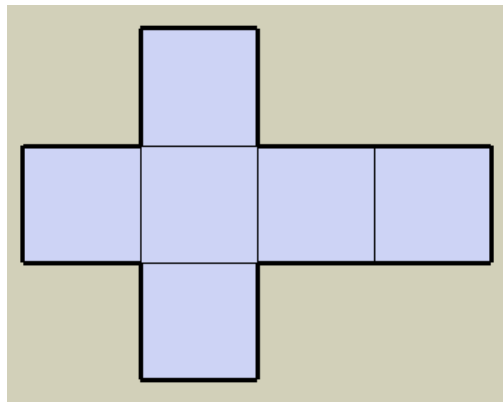
The Mac version is at www.3dvinci.net/SketchUp_Intro_Mac.pdf.

First, some easy folding, to make a cube and pyramid:

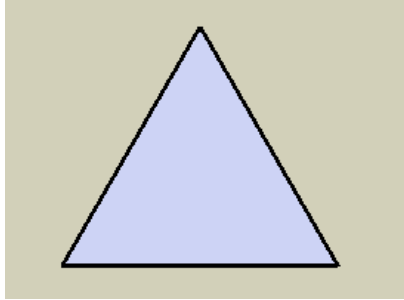
1. This should be done in **Top** view (**Camera / Standard Views / Top**). You will automatically open SketchUp in top view if you choose one of the “plan view” templates at startup.
2. Use the **Rectangle** tool to make a square.



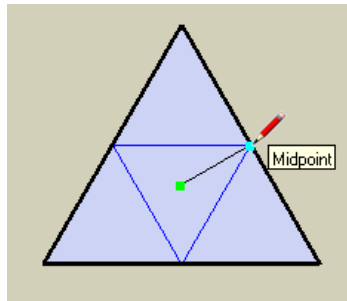
3. Copy the square like this, so that you have six total. This is an unfolded cube (there are several other ways to arrange the squares as an unfolded cube).



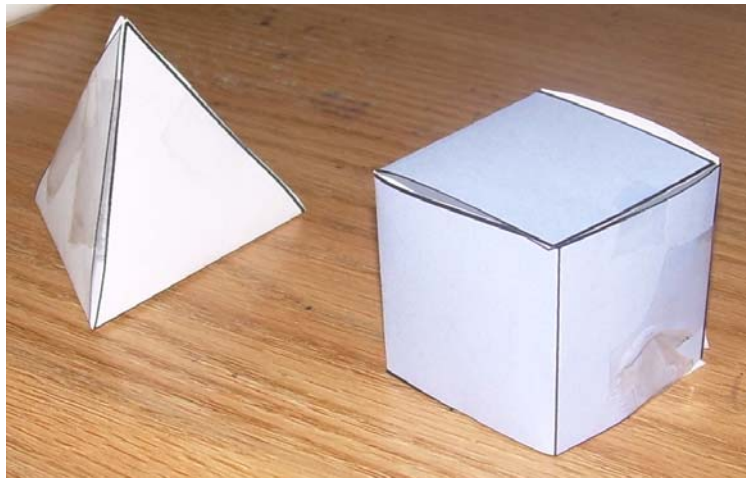
4. For the pyramid, use the **Polygon** tool to make a triangle.



5. You could make copies of the triangle, but an easier way is just to make another triangle inside the first one.

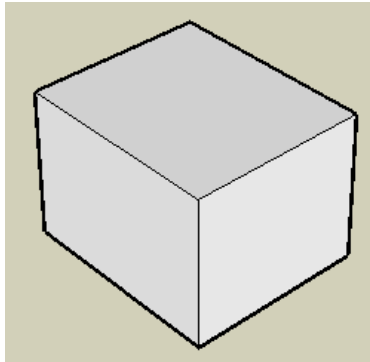


6. Use **File / Print** to print the sets of squares and triangles. (There's an option in the **Print** window to fit everything in one page.) Then cut out the shapes, and fold and tape them into place.

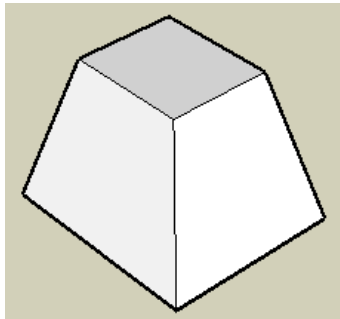


Now let's do the reverse: make a 3D shape in SketchUp and unfold it in SketchUp.

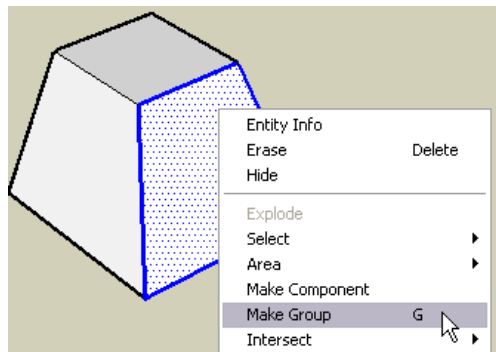
1. Use **Rectangle** and **Push/Pull** to make a box.



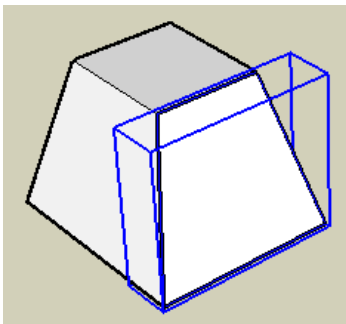
2. A box is boring, so we'll make it more interesting. Use **Scale** on the top face to shrink it. (Press Ctrl / Option while using **Scale** to scale about the center of the face.)



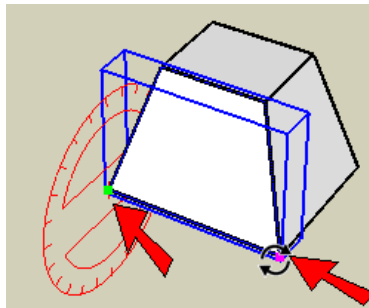
3. You can't unfold the faces like this, because they are all stuck together. To separate them, each face must be a group. Select a face plus its edges (while using **Select**, you can double-click a face for this). Right-click on the face, and choose **Make Group**.



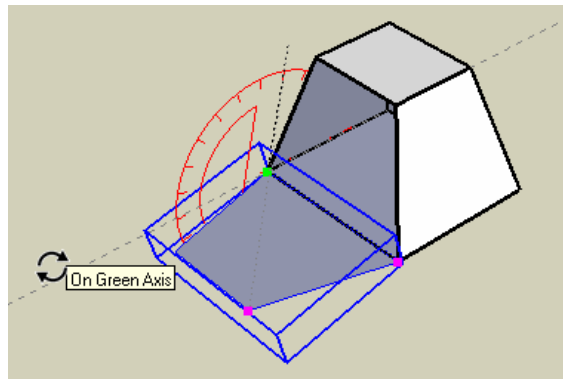
You should now see a bounding box around the face.



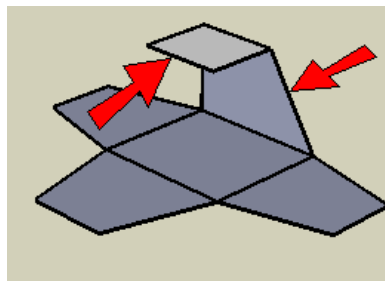
4. Do this for every face on the box. (You don't have to make a group out of the bottom face.)
5. To unfold, **Select** the face you want to unfold, and activate **Rotate**. To set the rotation axis, click on one endpoint and keep the mouse button pressed. Then drag the mouse to another point on the axis and release the mouse button.



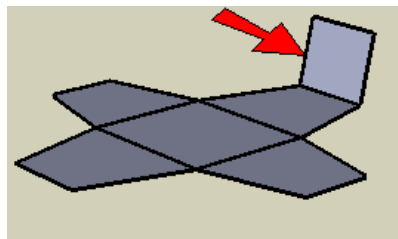
6. Then you can unfold the face so that it's lying flat.



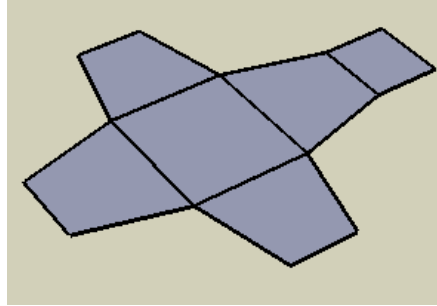
7. Keep unfolding faces one by one. When you get to this stage, you have two connected faces that need to be unfolded together. (If you just unfold the larger vertical face, the top face will be left hovering alone in space.)



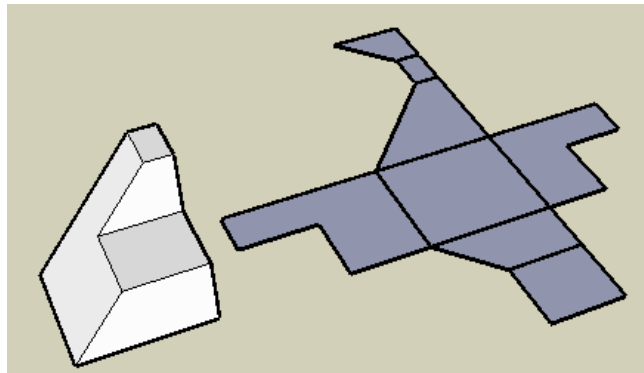
8. So **Select** both of these faces and unfold them. This leaves the small top face still sticking up.



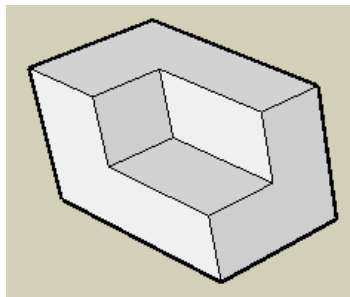
9. Finish up by flattening that last face. Now you can print and fold this to get your box.



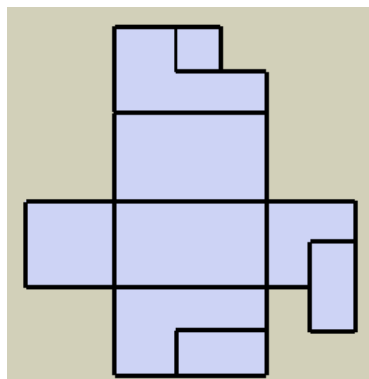
Here are some more interesting examples. For this one, you need to be careful to unfold multiple faces at once, so that no faces are left alone in space.



This one is especially tough - a box with a smaller box cut out at one corner.



This is how the shape above looks when unfolded. It's tricky - make sure you don't unfold to get any overlapping faces! Also be careful when you print, cut, and fold the one above. Where you have faces of the cutout box, you need to know which edge to cut!



If you like this project, please check out 3DVinci's *GeomeTricks Series* (<http://www.3dvinci.net/ccp0-catshow/GM.html>). The books shown below are among those that are appropriate for this age group, and teach concepts such as periodic and aperiodic tiling, fractals, and 3D Solids. Click each book graphic for more information.



And if you want to receive three ready-to-use projects like these each month, sign up for our SketchUp Projects of the Month subscription (<http://www.3dvinci.net/ccp0-prodshow/POM.html>). Each month, you'll get one project related to geometry, and two projects that teach a 3D design concept.

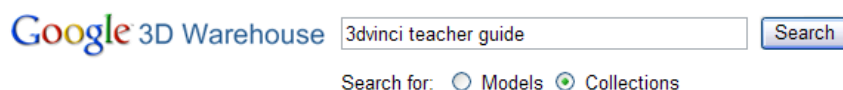
Also, be sure to check out our free geometry projects at www.mathforum.org/sketchup/!

All of the models in the Teacher Guide can be downloaded from Google's 3D Warehouse: <http://sketchup.google.com/3dwarehouse>.

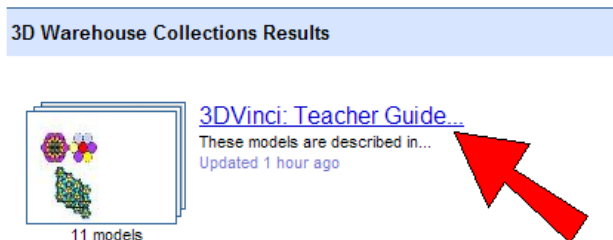
- Click [this link](#) to see the entire Warehouse collection of models used in the Teacher Guide.
- Click [this link](#) to locate this exact folding model in the Warehouse.

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3. Open this link:



4. In the collection, find the model you want, and open or download it.

Google SketchUp Math Project: Grades 10 - 12



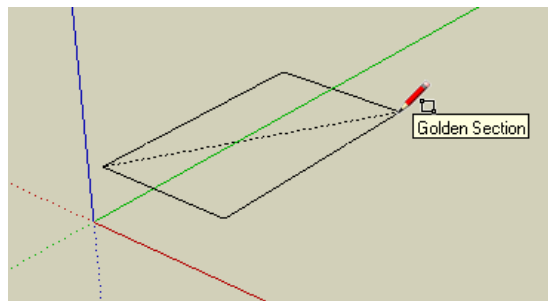
It's amazing what you can make when you start with the famous rectangle known as the “golden section.” Here are three such objects.

If you need some basic information on downloading Google SketchUp, or about its user interface and basic tools, please see our printable “Intro to SketchUp” PDF.

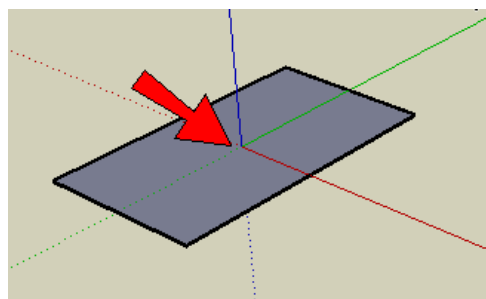
The PC version is at www.3dvinci.net/SketchUp_Intro_PC.pdf.

The Mac version is at www.3dvinci.net/SketchUp_Intro_Mac.pdf.

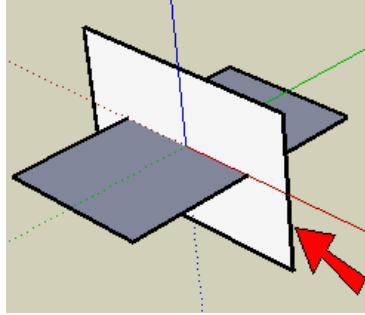
1. Use the **Rectangle** tool to draw a golden section on the ground (red-green plane).



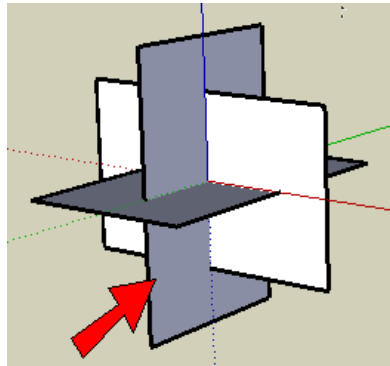
2. It's easiest to complete this project if the rectangle is centered at the origin. So use **Move** to place it there. (If you need, you can make a dummy line to help while moving, then erase it.)



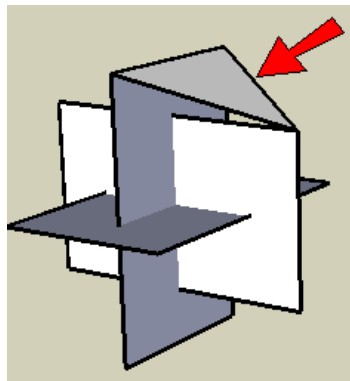
3. Rotate-copy the rectangle once, then rotate the copy, to get this. (Having the center at the origin makes rotating much easier.)



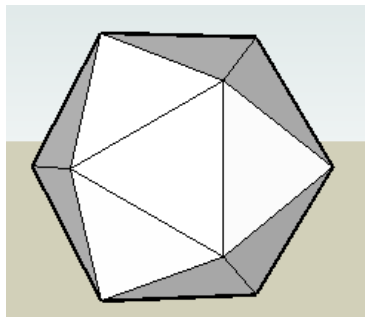
4. Repeat the last step in the other direction. Now you should have three golden rectangles that are all centered at the origin.



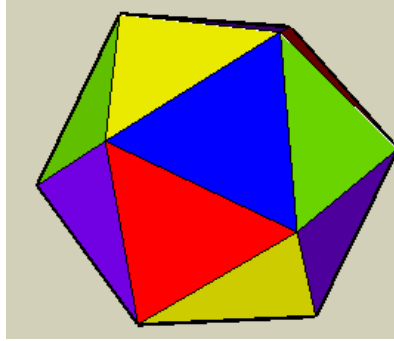
5. Use **Line** to connect a corner point of one rectangle to the two corners of the edge closest to it. This makes your first triangle, which is equilateral (all sides equal).



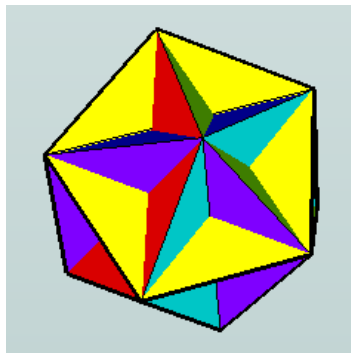
6. Create the rest of the triangles the same way. There should be 20 triangles in all. You've just made an icosahedron.



7. Here's a challenge: color the icosahedron using only five colors, so that no color is repeated at any corner.

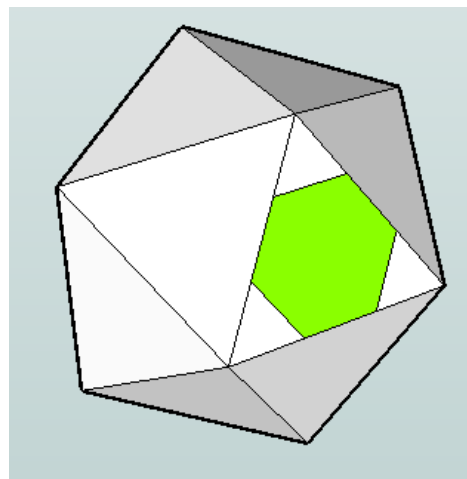


8. Make a copy of the icosahedron, and on this copy erase each of the 20 triangles. You will have this object, where each “main” face is a pentagon with a star sticking out of it. Another challenge: color these faces using only six colors, so that each pentagon / star face has no repeating colors.

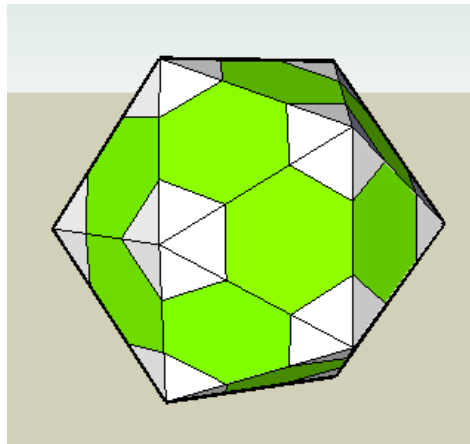


This object is called a “great dodecahedron” (<http://mathworld.wolfram.com/GreatDodecahedron.html>). Another great exercise is to “unfold” it, using the methods described in the Math Project for Grades 6-9.

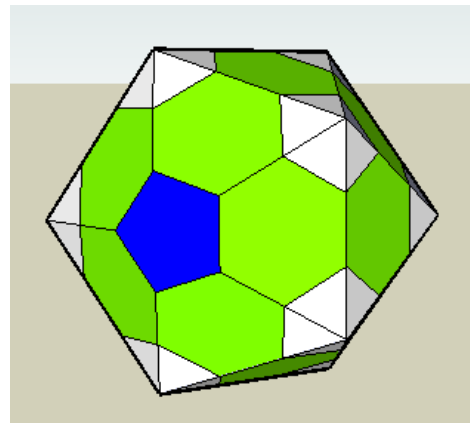
9. We'll do one last thing with the icosahedron (make a copy or use the original one). On one of the triangles faces, make a hexagon. To do this, you can divide each triangle edge into three segments, by right-clicking on each edge and choose **Divide**. Then you can connect the endpoints of these new segments.



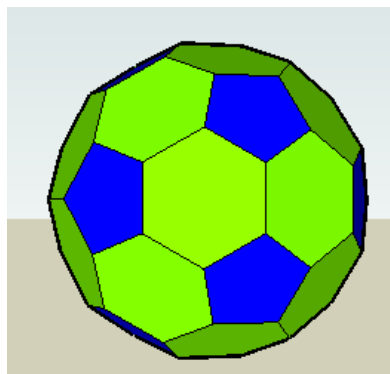
10. Copy this hexagon to the other 19 faces. Use the **Rotate** tool for this, using the click-and-drag method to set the rotation axis. Remember to use the Ctrl / Option key to make copies.



11. You now have five sets of triangles between each ring of five hexagons. Erase the edges of these triangles, and use **Line** to replace the face where you're left with a hole. This new face is a pentagon.



12. Do this at every corner, until you have filled in all 12 pentagons. Behold: a soccer ball! (Or bucky ball, or football if you're in Europe.)



There is no limit to what you can create with a set of three golden sections. And for more advanced users, if you understand about components and scaling, you can complete these projects a bit faster.

If you like this project, please check out 3DVinci's *GeomeTricks Series* (<http://www.3dvinci.net/ccp0-catshow/GM.html>). The books shown below are appropriate for this age group, and teach how to create Platonic and Archimedean solids, as well as some amazing derivative compounds and other objects.



And if you want to receive three ready-to-use projects like these each month, sign up for our SketchUp Projects of the Month subscription (<http://www.3dvinci.net/ccp0-prodshow/POM.html>). Each month, you'll get one project related to geometry, and two projects that teach a 3D design concept.

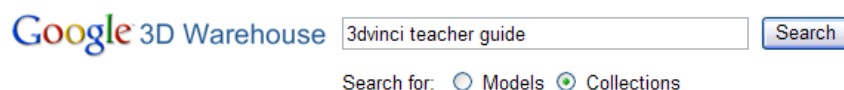
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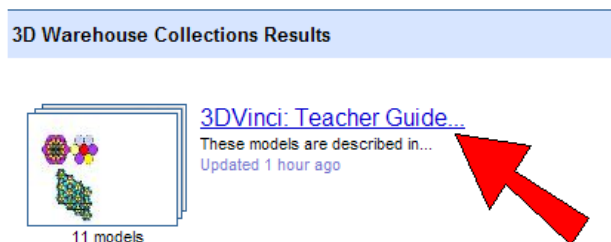
- Click [this link](#) to see the entire Warehouse collection of models used in the Teacher Guide.
- Click [this link](#) to locate this exact golden section model in the Warehouse.

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3. Open this link:



4. In the collection, find the model you want, and open or download it.

Google SketchUp Science / Geography Project: Grades 1 - 5



SketchUp can be used for projects in almost any subject, which makes it especially perfect for classes that combine subjects.

This project uses Google Earth, another free product by Google. SketchUp and Earth work in tandem with each other: you can bring a “slice” of Earth into SketchUp and build something on it, then bring that model into Earth.

You can download Google Earth at <http://earth.google.com>.

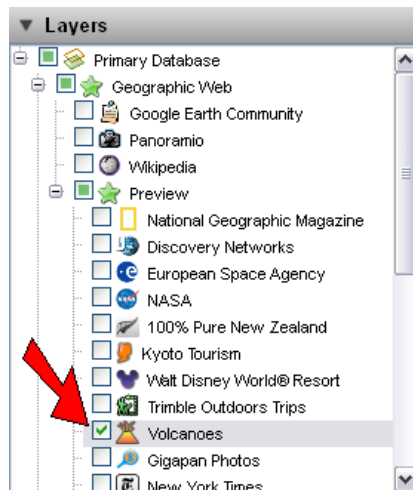
If you need some basic information on downloading Google SketchUp, or about its user interface and basic tools, please see our printable “Intro to SketchUp” PDF.

The PC version is at www.3dvinci.net/SketchUp_Intro_PC.pdf.

The Mac version is at www.3dvinci.net/SketchUp_Intro_Mac.pdf.

In this project, we’ll go searching for a volcano. Once we find it in Google Earth, we’ll decide what we want to build on it, and for what purpose.

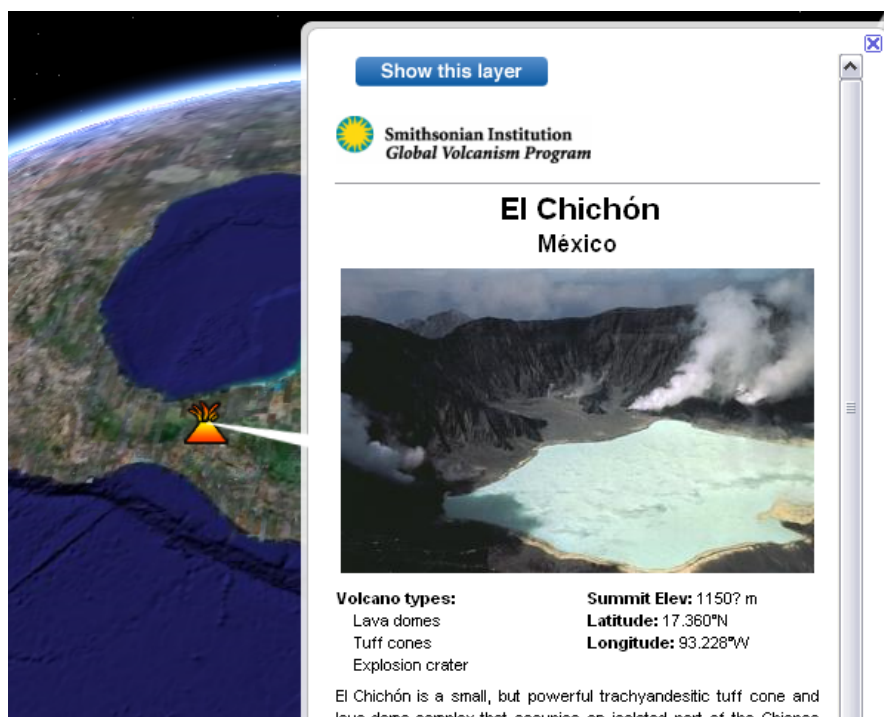
1. Start Google Earth. Before searching for a particular place, look at the **Layers** window at the bottom left. There is a huge number of items you can display, but too many of these things will clutter your screen and make things move too slowly. So uncheck everything, except for “Volcanoes.”



2. Now you can spin around Earth, looking for volcanos. You can use Earth's navigation controls or click and drag your mouse. You need to zoom in a little to see the volcano markers. For examples, here are two volcanos - one in Mexico and one in Costa Rica.

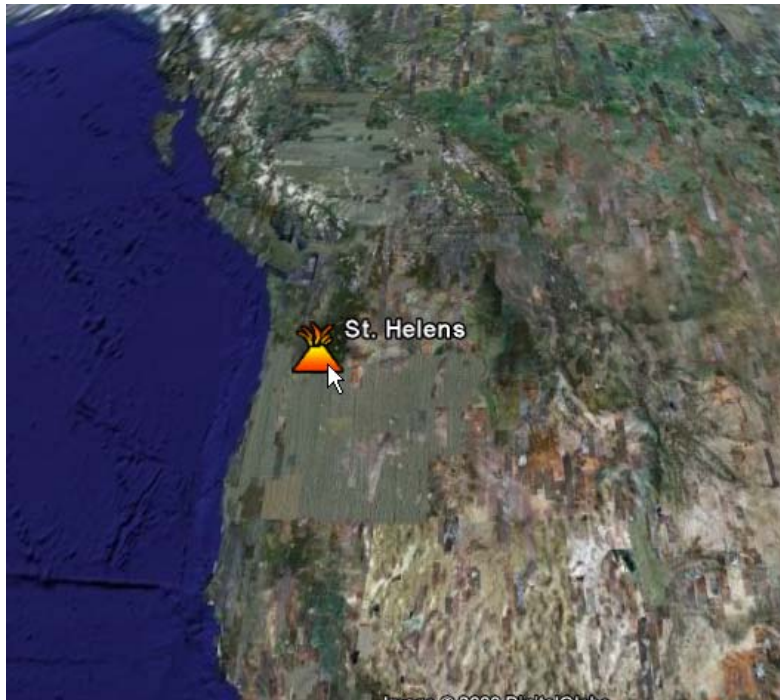


3. To get information about the volcano, click the volcano marker. This one is called “El Chichon,” and you can find facts about its location and altitude.

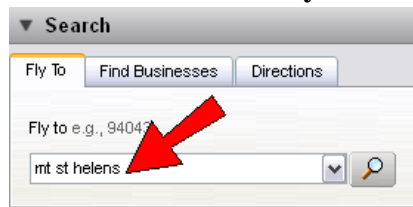


Other famous volcanoes to find are Fuji in Japan, or Mauna Loa in Hawaii.

4. The one where I'll be building is Mount St. Helens, in Washington State, USA. Try to find it by spinning around the world.



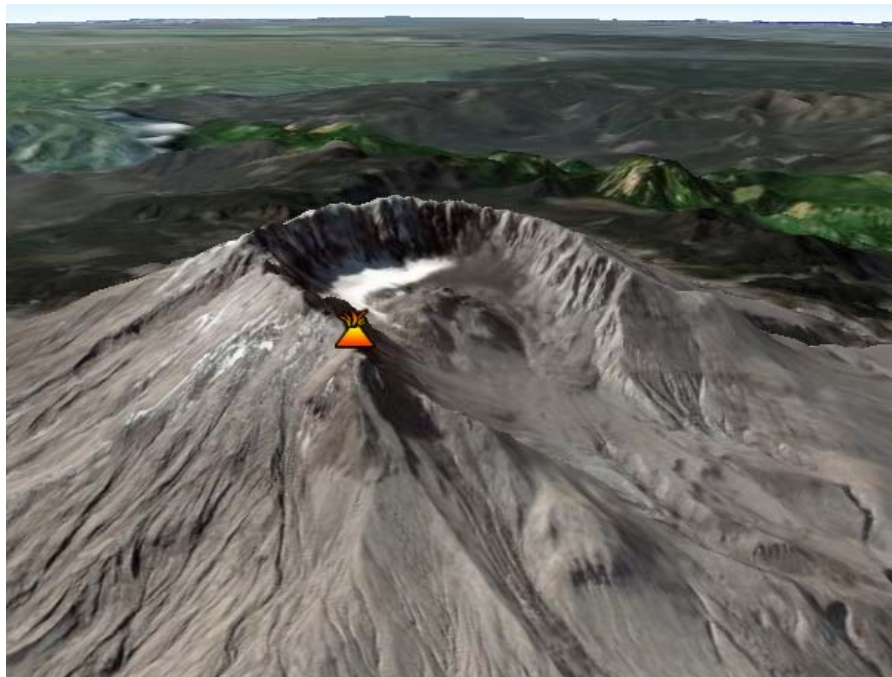
If you can't find it this way, enter "Mt St Helens" in the **Fly To** field of the **Search** window.



5. If you zoom out a little, this should be your view. It's a large volcano with an interesting shape (it erupted in 1980 and some of the volcano top spilled down the slope), which is why I chose it for this project.



6. To see the shape in 3D, use the navigation controls or drag your mouse up and down.

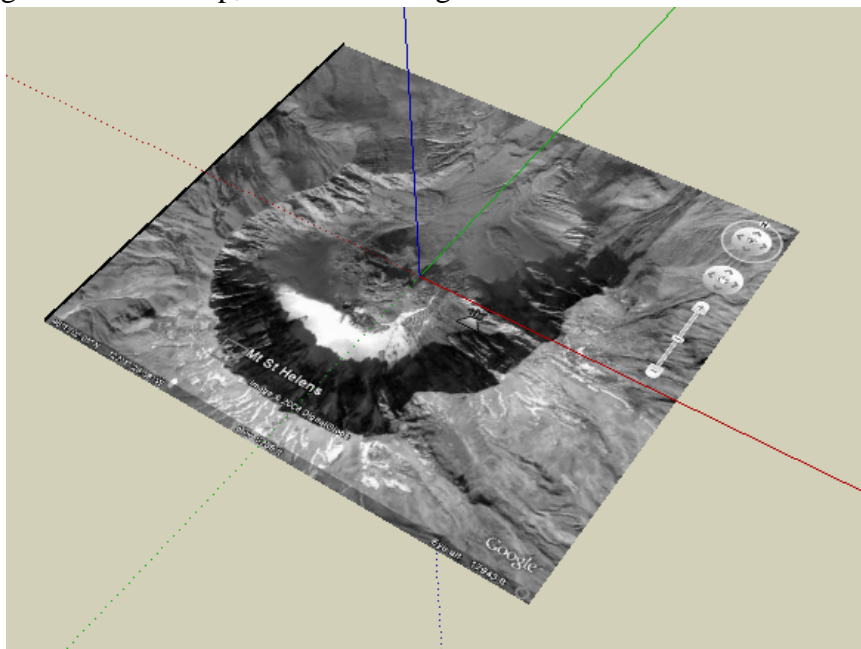


7. Go back the bird's-eye view. When you bring a piece of Earth into SketchUp, you should always be looking straight down at the ground (or volcano top in this case).

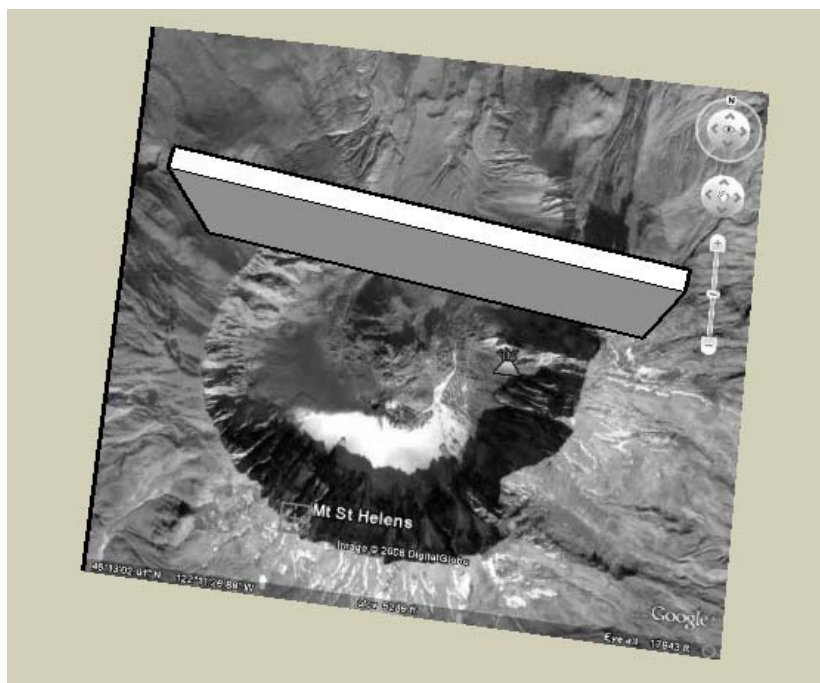
8. Open SketchUp, and click **Get Current View**.



Your view is brought into SketchUp, as a flat rectangle.



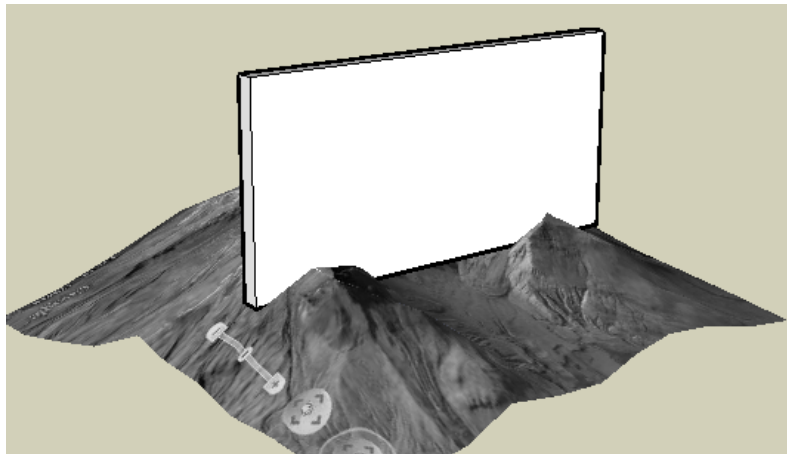
9. What to build here? I'll try for something relatively simple - a retaining wall that will block any lava from spilling down the mountain in the future. Plus an observation bridge that crosses over the volcano. On the flat SketchUp rectangle, draw the rectangle you want to use for the wall, and use **Push/Pull** to pull it up.



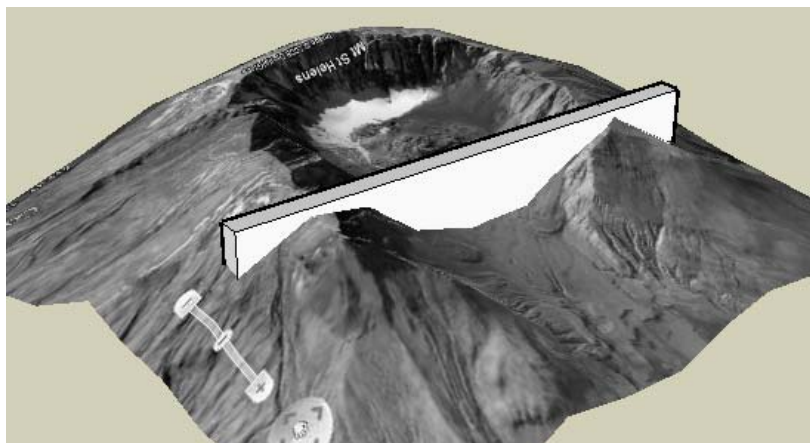
10. We know this volcano isn't flat, and we should see how it really looks in 3D before we start making our model. So click **Toggle Terrain**.



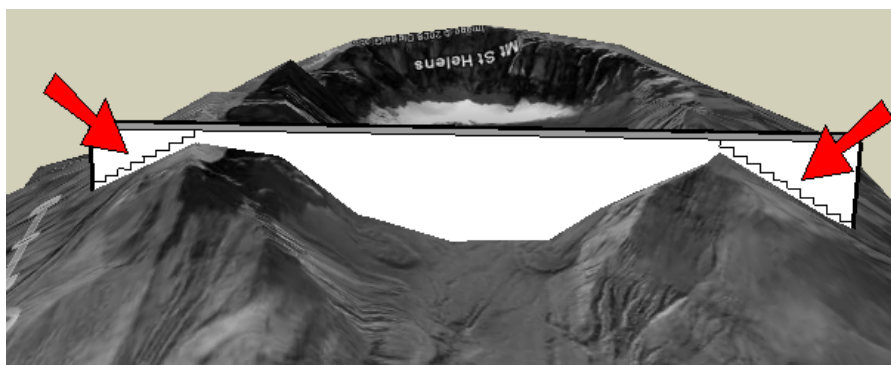
Now you can see the mountain.



11. Use **Push/Pull** to make the wall the right size. You might have to flip the volcano upside-down to pull the wall down far enough.

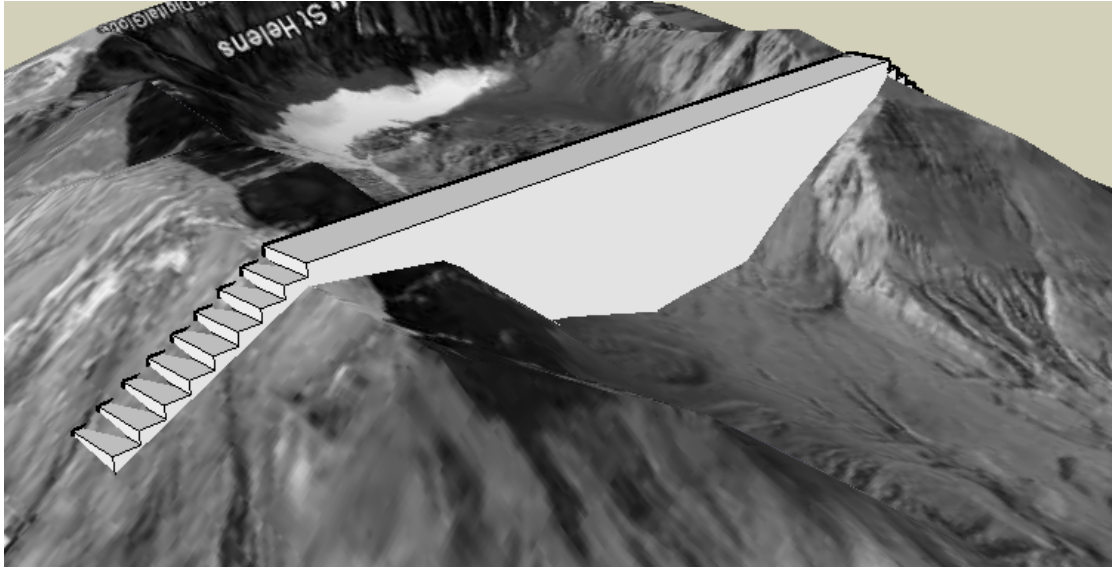


12. I'm adding steps on either side, for easy access. You can use **Line** to make the step outlines.

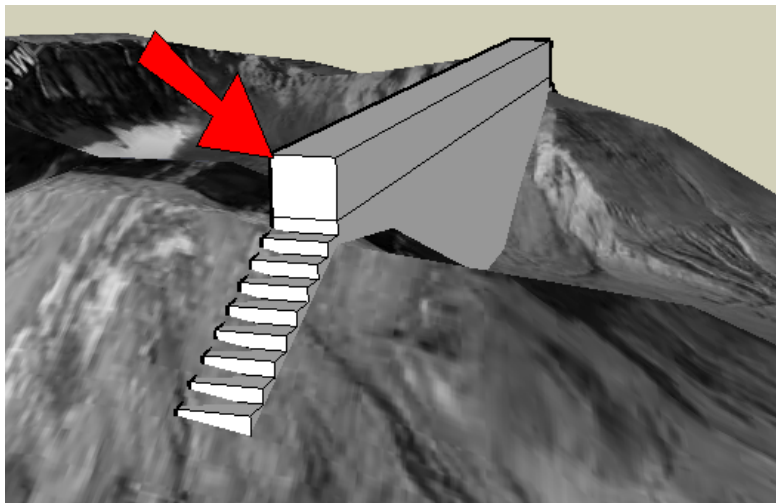


If you pay attention to the measurements of your lines, you'll see how huge they are. Obviously, this model scale doesn't have to be very accurate.

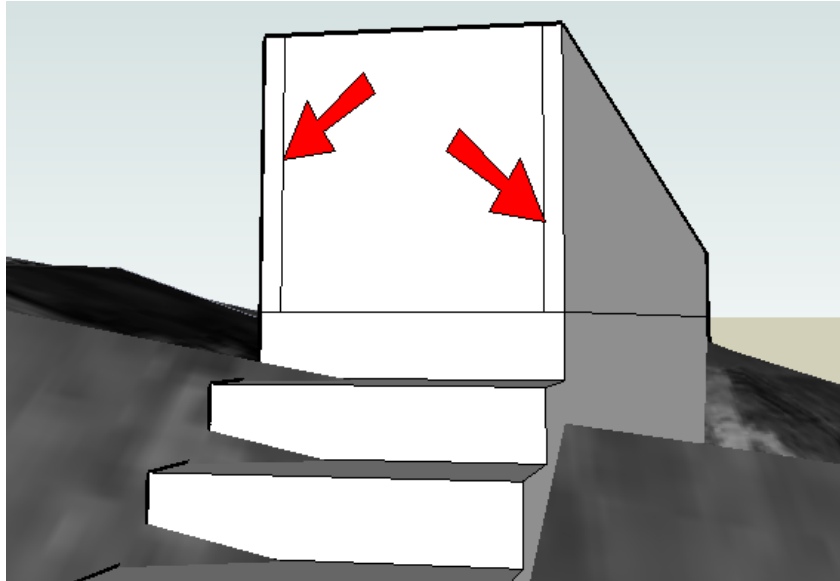
13. **Push/Pull** the steps out.



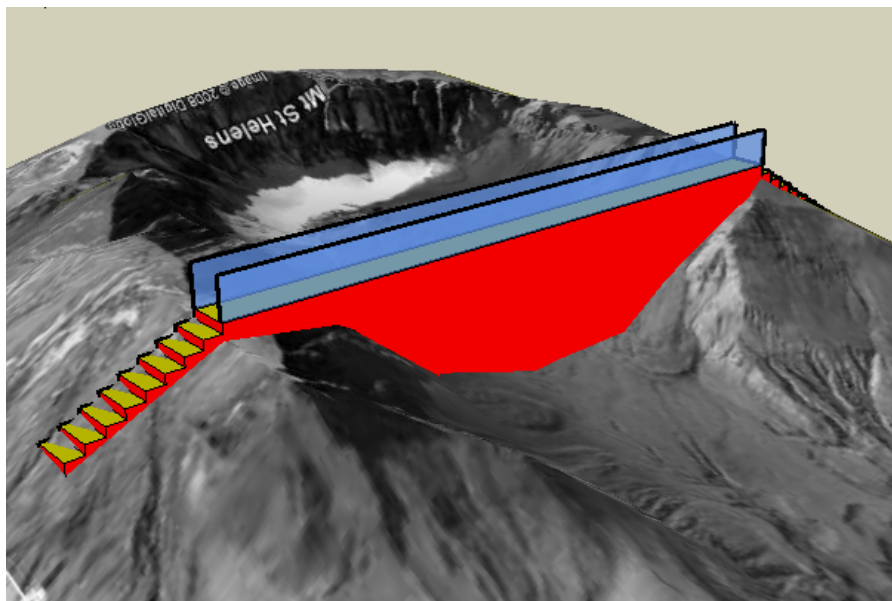
14. For an observation area, we need a protective wall. So pull the top up. (Press the Ctrl / Option key when using **Push/Pull** if you want to create a new set of faces.)



15. Then use **Rectangle** or **Line** to create the edges for the protective wall.



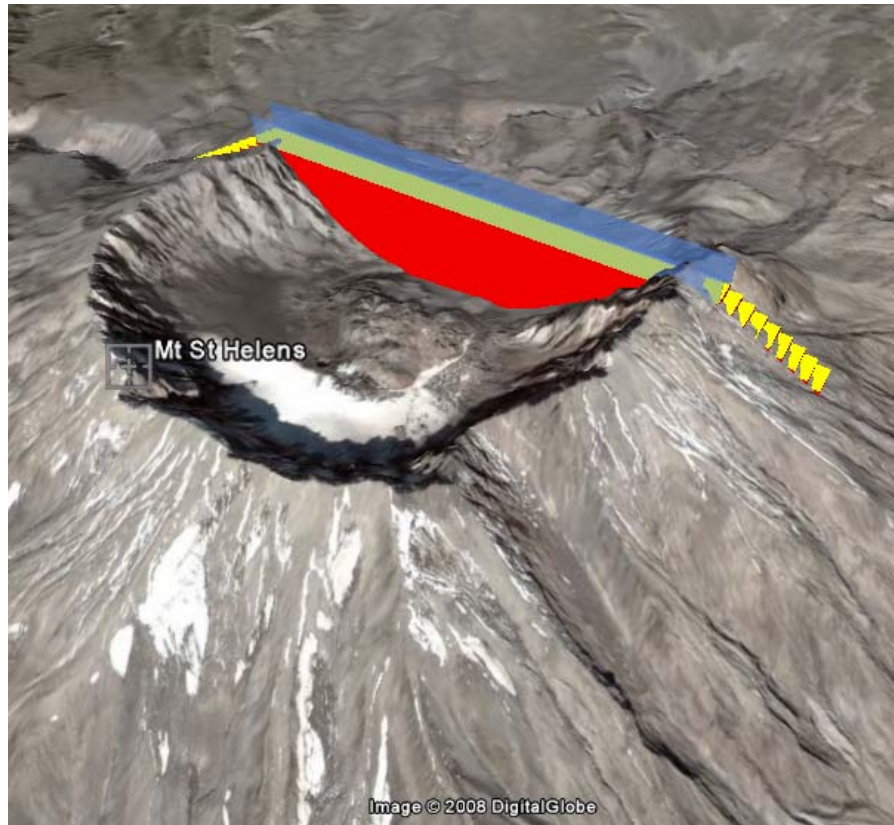
16. Pull out the middle, and paint your wall. I used a translucent color for the protective wall to make it easier for visitors to see what's going on. No lava will get through here next time!



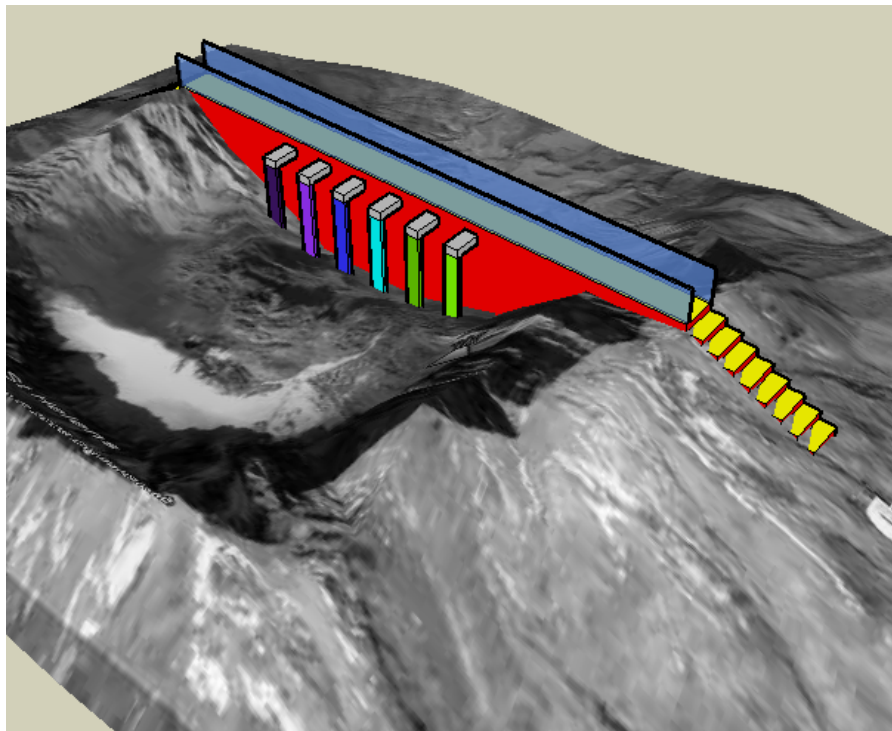
17. To place your wall in Google Earth, click **Place Model**.



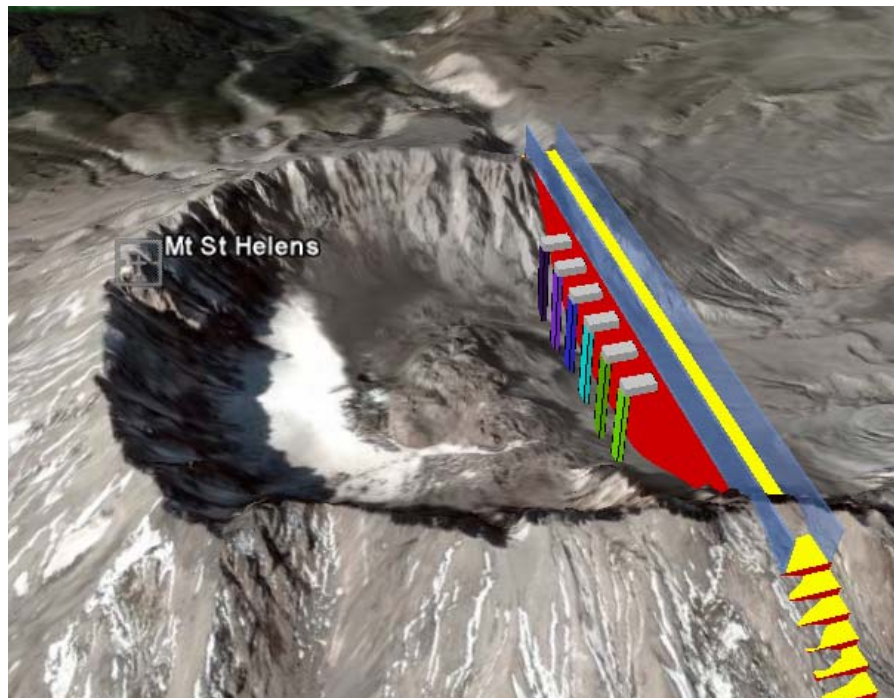
18. Go back to Earth to see it.



19. To make this model more useful, we can add a scientific testing station. I'm not sure exactly what this would look like, perhaps a series of pipes coming out of the wall which will measure chemical levels or test temperature. Go back to SketchUp and make whatever changes you like to your model.

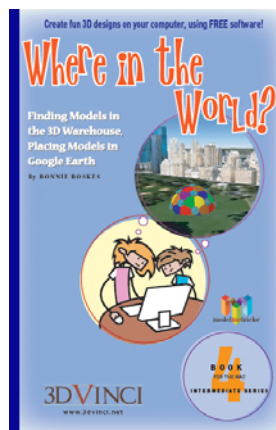


20. Click **Place Model** again, and go back to Earth (you'll have to confirm that you want to replace the model that's already there. Here's your observation center / testing lab / retaining wall.



21. This model is in your Google Earth as a temporary place - it is not on the "main" Google Earth that everyone sees. If you want to save this place in Earth, use **File / Save / Save Place As**. The file extension is .kmz. You can save your SketchUp file as well, which will keep its location information. If you open a saved SketchUp file with location information, you can always use **Place Model** to see where it ends up in Earth.

If you like this project, please check out 3DVinci's book Where in the World? (http://www.3dvinci.net/ccp0-prodshow/MI4_PDF.html). This book teaches all you need to know about integrating models into Google Earth, including how to change and relocate models. It also covers how to find just what you need in the 3D Warehouse.



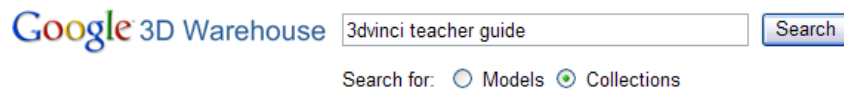
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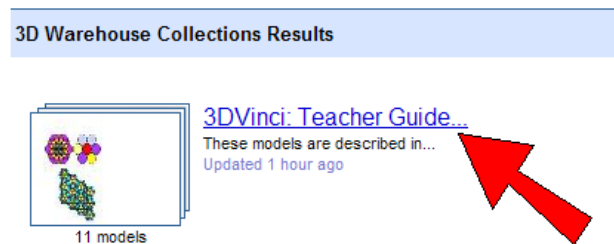
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3. Open this link:



4. In the collection, find the model you want, and open or download it.

Google SketchUp Art / History Project: Grades 6 - 9



SketchUp can be used for projects in almost any subject. And with so many classes combining subjects, SketchUp fits right in.

This project involves finding paintings on the Internet and placing them on the walls of an art museum. This sort of project could be great for a class learning about periods in art history, or studying a series of paintings by a particular artist. The art placed on the walls can even be the students' own work, if it's in digital format.

If you need some basic information on downloading Google SketchUp, or about its user interface and basic tools, please see our printable "Intro to SketchUp" PDF.

The PC version is at www.3dvinci.net/SketchUp_Intro_PC.pdf.

The Mac version is at www.3dvinci.net/SketchUp_Intro_Mac.pdf.

The first step is to find the painting we want to "hang" on the walls. Each painting will be placed in a frame and saved in its own file. Then when all the paintings are ready, we'll build the museum and bring the paintings to the walls.

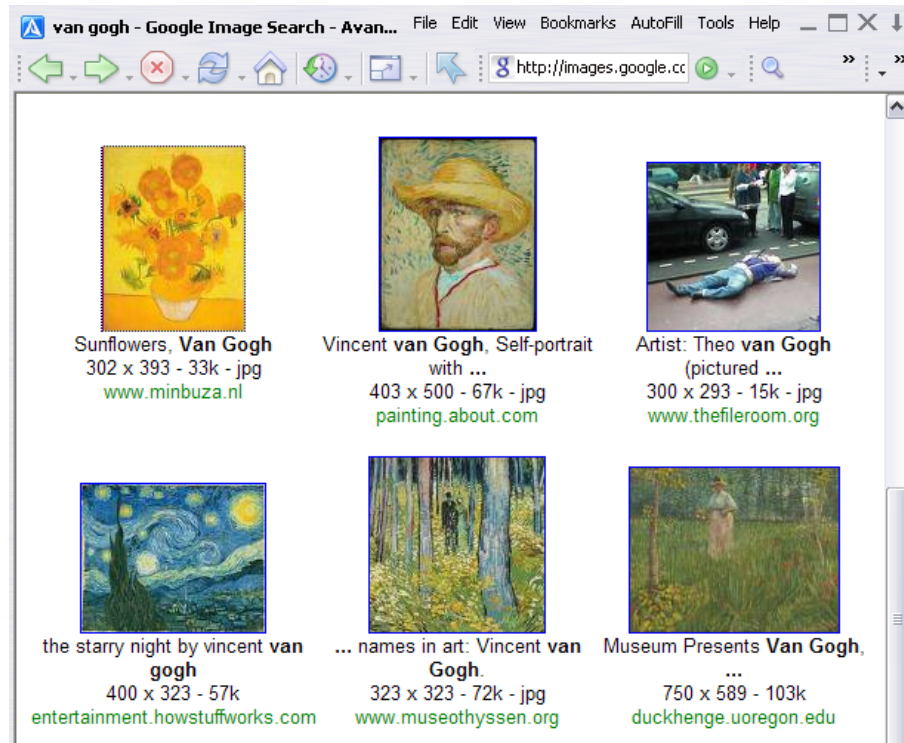
1. The easiest way to find a painting is via a web search. Both Google or Yahoo provide a separate link just for image searching.



2. Enter the name of the artist or painting in the Image Search field.

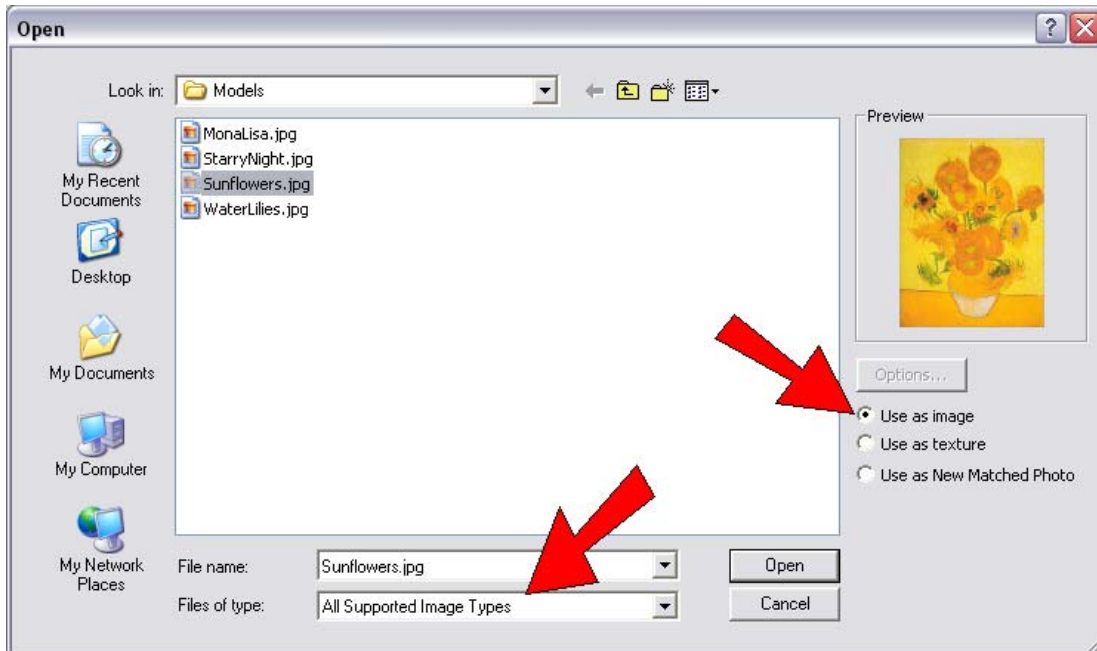


3. The search results will show thumbnails of all relevant images. When you save an image from here, you want to be sure to save the largest resolution available. So click on the thumbnail to see the larger version.

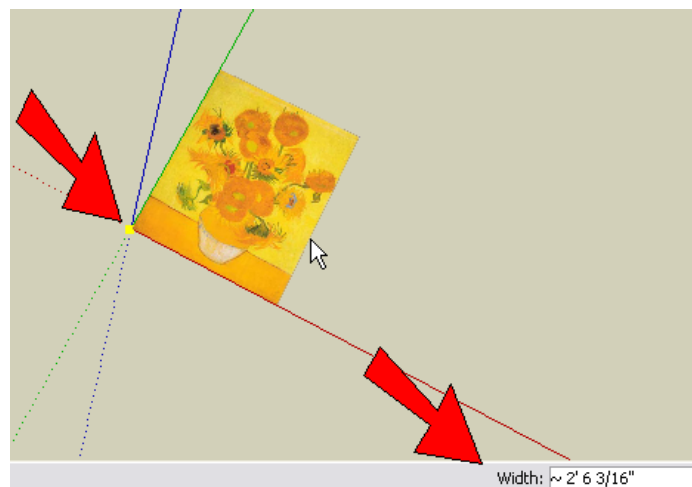


4. When you get to the largest version of the image, right-click on it and choose **Save Picture As**. (On the Mac, choose **Save Image**, or **Save Image to the Desktop**.) Save it somewhere you will remember!

5. Now open a new SketchUp file, and choose **File / Import**. Make sure you are looking for image files, and check **Use as image**. Browse to the folder where you saved your painting image, and click **Open**.

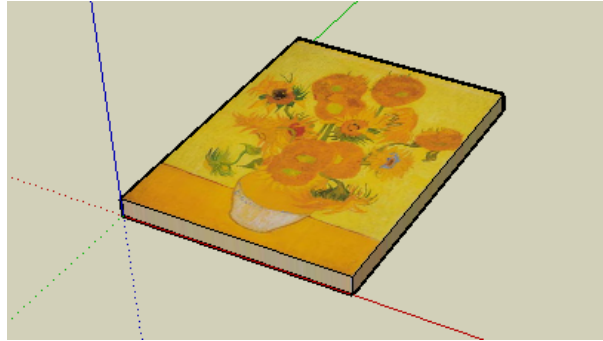


6. The image comes in attached to your cursor. Place one corner at the origin. While you're sizing the image rectangle, watch the **Width** or **Height** value in the box below the SketchUp window. This number doesn't have to be exact, but it should be logical (a 40-foot tall painting won't fit on many walls!).

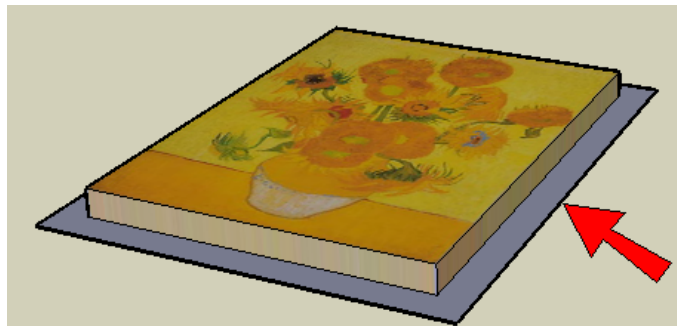


7. To make a SketchUp face out of this image, right-click on it and choose **Explode**.

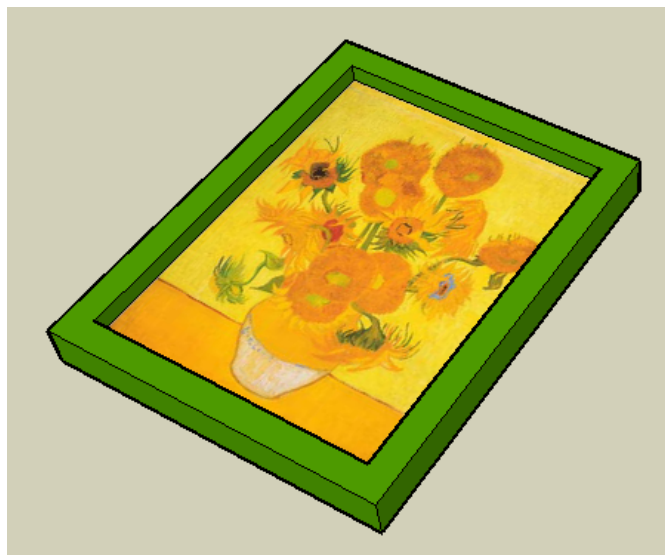
8. It's not recommended to keep the painting face flat, because it won't look quite right when you place it on a wall (both the painting and the wall will be in the same exact spot, so SketchUp can't tell which should be in front). So **Push/Pull** the painting up a small amount.



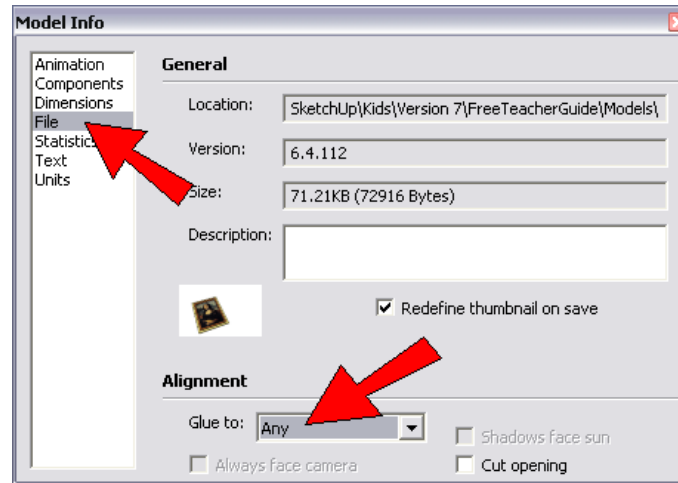
9. We could save the painting like this, but it's more interesting to give it a frame. Use the **Offset** tool on the back face of the painting to make a slightly larger rectangle.



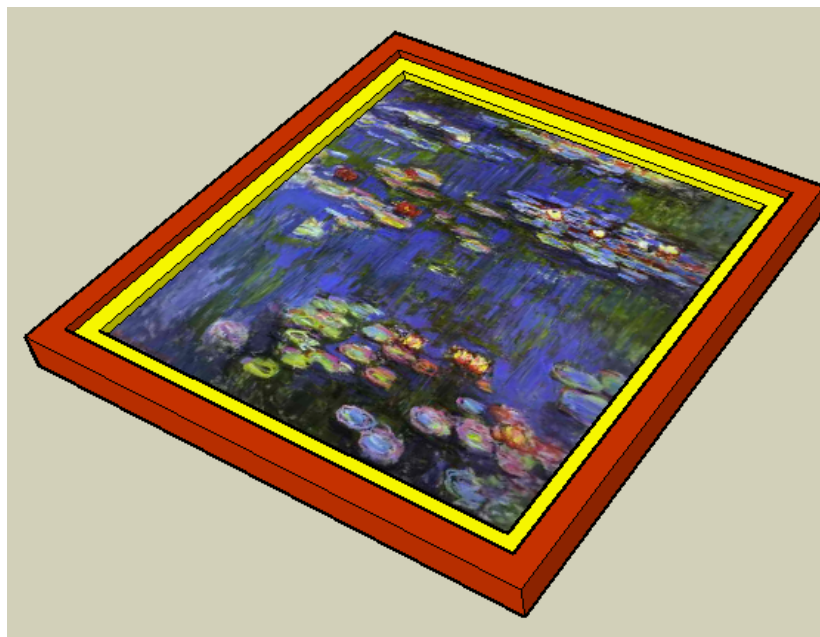
10. Then use **Push/Pull** to make the frame, and color it.



11. Here's a very important step when you're making a model you'll be using later in another model. We need to determine how this painting will align when it's imported into the museum. So choose **Window / Model Info**, and open the **File** page. Next to **Glue to**, choose **Any**. This means when it's imported, the painting will align to any face, whether the face is vertical or horizontal or sloped.

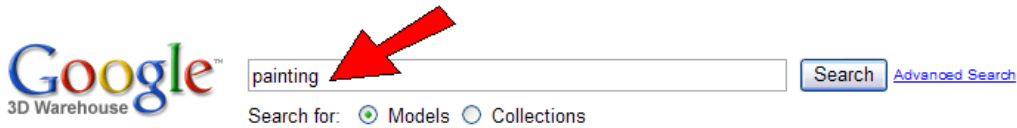


12. Before saving, make sure there's nothing in the file except for the painting. (If you have a person in your file, erase it.) Then use **File / Save As** to save the model.
13. Do the same for the other painting images you found online, saving each painting and frame in its own file. You can make frames as fancy as you want - in this example I used **Offset** twice to make two frame rectangles, and pulled each one up by a different amount.



The **Follow Me** tool is great for creating frames, using any kind of cross-section you want.

14. If you don't want to create your own painting models, there are many models like this in Google's 3D Warehouse. The Warehouse is a place where anyone can upload any model (within reason), and any model can be downloaded by anyone. To enter the warehouse, go to <http://sketchup.google.com/3dwarehouse>. Enter what you're looking for, such as "painting," "frame," or the name of an artist or painting.



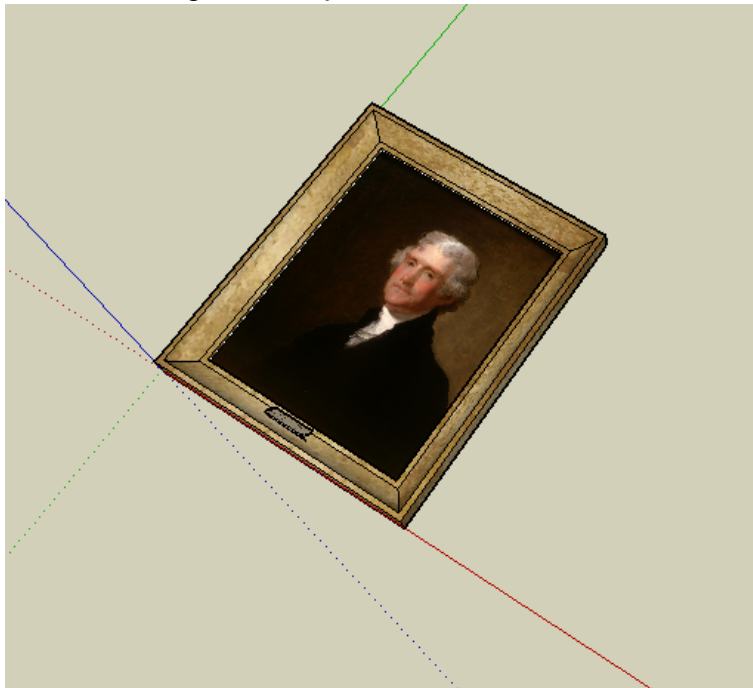
15. Here's one I found - a portrait of Thomas Jefferson. To save it, click **Download Model**.



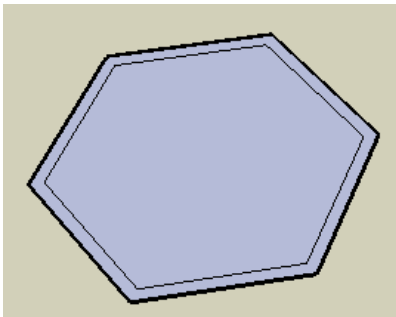
You need to be careful with models you get from the Warehouse, because the quality is not guaranteed. For example, this model is located far from the origin, and is vertical (the ones we made ourselves are flat on the ground).



16. So be sure to “fix up” your Warehouse model before saving it. For this one, I moved and rotated it so that it meets the origin, and the vertical side is parallel to the green axis. I also made sure the image wasn’t flat, and changed the **Model Info** window to glue to **Any** face.

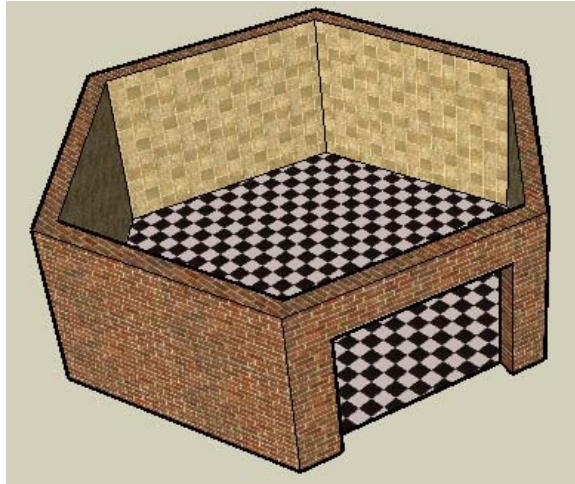


17. When you have enough paintings, start a new file for the museum building. Mine will be just one big room, shaped like a hexagon. I used the **Polygon** tool, and entered 6 for the number of sides. Then I used the **Offset** tool to create another hexagon, to make a set of walls around the hexagon.

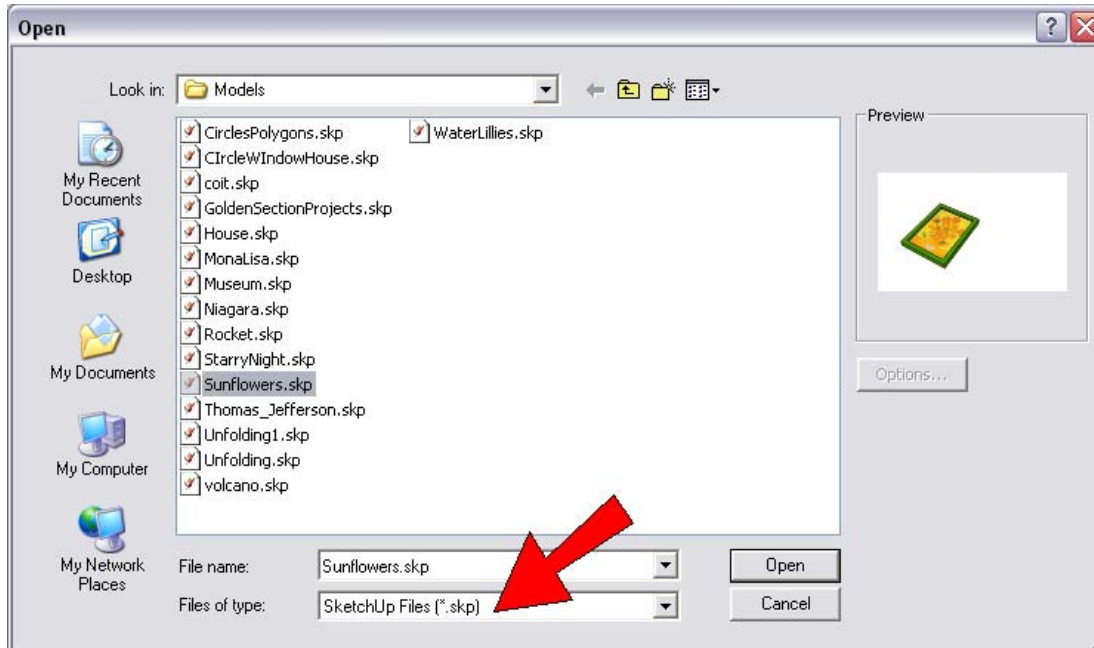


You would probably want to make a larger museum (at least with more than a single room), and perhaps with more than one floor.

18. Leave off the roof (for now), and add an opening for a door.



19. To bring in the first painting, choose **File / Import**. Make sure this time you're searching for SketchUp files.

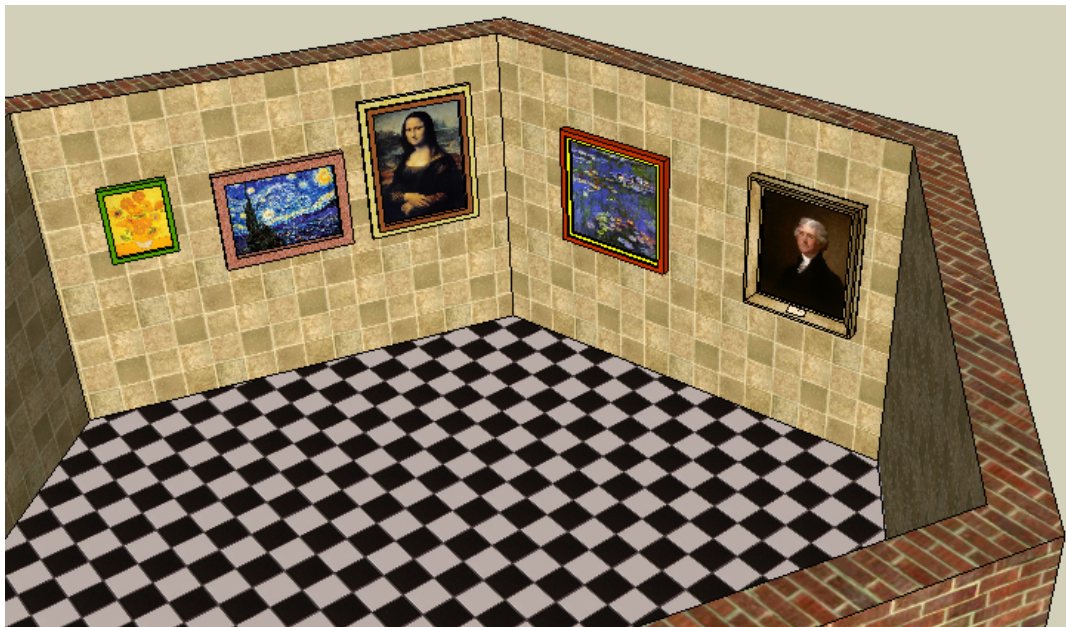


20. Models brought in this way are actually components. And because the painting models are set to glue to any face, they should be vertical when placed on a wall.



*If the painting looks too big or small, you can use the **Scale** tool to change its size.*

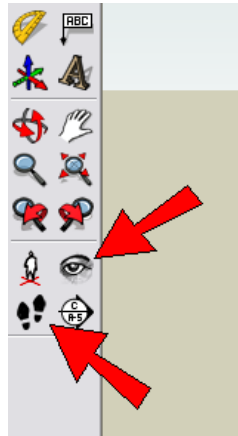
21. Bring in each painting the same way, and we're done!



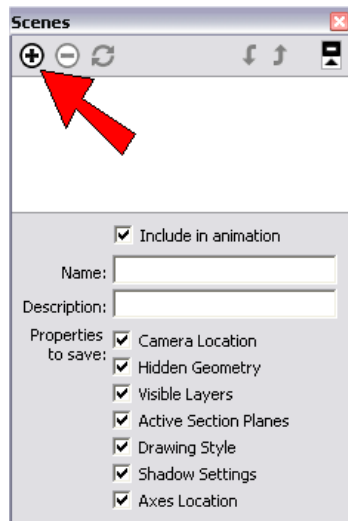
Here are some ways to expand on this project idea:

- Group paintings from the same period (or artist, or painting “school”) in their own rooms.
- Make separate collections for paintings from different regions of the world.
- Use digital images as the paintings (images can be of students, nature, architecture, etc.)
- Take actual student paintings and scan them, and use the digital images as the paintings.

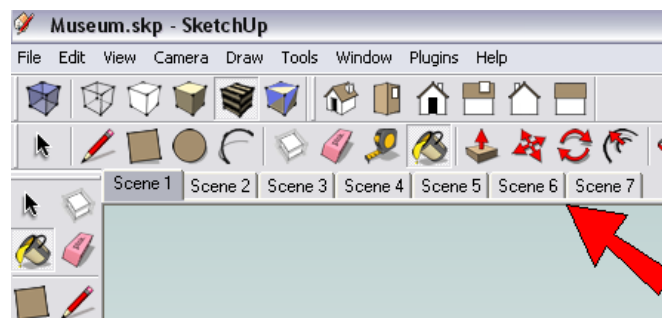
Another excellent way to expand on a museum project is to make a slide show, or animation. SketchUp has a few tools you can use to “walk through” a model: **Walk**, **Look Around**, and **Position Camera**. It’s hard to explain in writing how to use these - the best way to get to know these tools is simply to play with them.



When you have a view you want to save, you record it as a “Scene.” Open **Window / Scenes**, and click the “plus” sign to save a scene.



Create a scene for each view you want to save. The scenes appear as tabs at the top of the screen.



To play the animation of these scenes, choose **View / Animation / Play**. The view scrolls from one scene to the next, in order. To change how fast the scenes transition, use the **Animation** page of the **Model Info** window.

If you like this project, please check out the books below, part of 3DVinci's ModelMetrics Series (<http://www.3dvinci.net/ccp0-catshow/Kids.html>). These books teach all you need to know about using digital images in both 2D and 3D, as well as how to create other museum-worthy models.



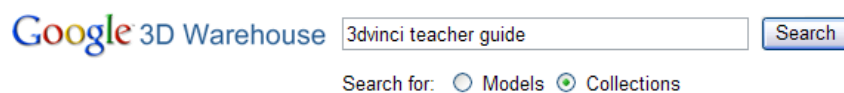
And if you want to receive three ready-to-use projects like these each month, sign up for our SketchUp Projects of the Month subscription (<http://www.3dvinci.net/ccp0-prodshow/POM.html>).

All of the models in the Teacher Guide can be downloaded from Google's 3D Warehouse: <http://sketchup.google.com/3dwarehouse>.

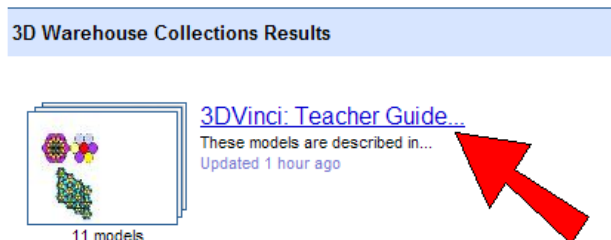
- Click [this link](#) to see the entire Warehouse collection of models used in the Teacher Guide.
- Click [this link](#) to locate this exact museum model in the Warehouse. This model has seven scenes - to play them as a slide show, choose **View / Animation / Play**.

If you're reading this as a printed PDF and can't click on the links, here's how to find the Teacher Guide models:

1. Open the 3D Warehouse.
2. In the **Search** field, type "teacher guide" and click **Collection**. Then press Enter or click the **Search** button.



3. Open this link:



4. In the collection, find the model you want, and open or download it.

Google SketchUp Geography / History Project: Grades 10 - 12



This project uses Google Earth, another free product by Google. SketchUp and Earth work in tandem with each other: you can bring a “slice” of Earth into SketchUp and build something on it, then bring that model into Earth.

You can download Google Earth here: <http://earth.google.com>.

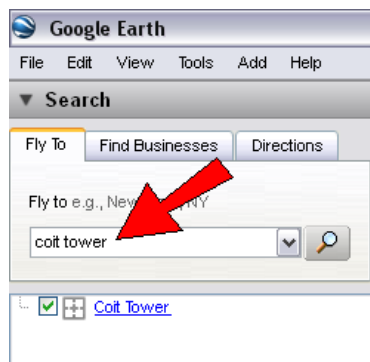
If you need some basic information on downloading Google SketchUp, or about its user interface and basic tools, please see our printable “Intro to SketchUp” PDF.

The PC version is at www.3dvinci.net/SketchUp_Intro_PC.pdf.

The Mac version is at www.3dvinci.net/SketchUp_Intro_Mac.pdf.

In this project, we want to build something on top of a hill. San Francisco, California is a pretty hilly town, and it happens that there is some space for a new building next to the famous Coit Tower. (The empty space is actually a parking lot, but we’ll ignore that.)

1. Launch Google Earth, and enter “Coit Tower” in the **Fly To** field. You can use this field to search for cities, landmarks, famous places, exact addresses, etc.



Earth moves to this birds-eye view of the tower.

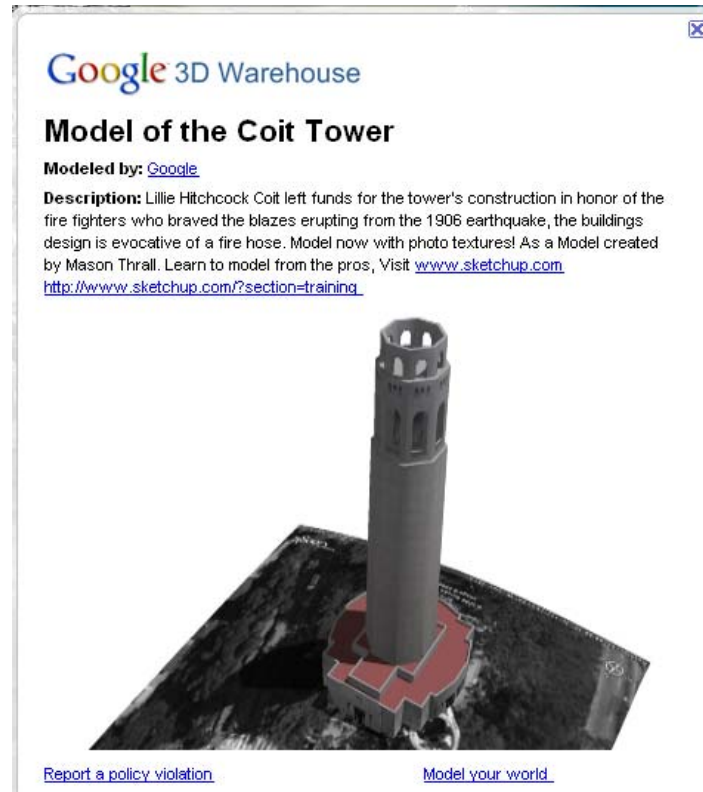


2. There is a layer in Earth called "3D Buildings" - make sure this is on, or you won't see any models. (You can turn off other layers, if Earth is moving too slowly or is too cluttered.) Use the navigation controls to zoom, pan, and orbit so that you can see the tower in a view like this. (Most navigation can be done with your mouse, using the left or middle mouse button and dragging up and down, left and right.) When the cursor is over the tower, the tower is highlighted.



When a building is highlighted like this, it means that it is stored in Google's 3D Warehouse. The Warehouse is a place where anyone can upload any model (within reason), and any model can be downloaded by anyone. To enter the warehouse, go to <http://sketchup.google.com/3dwarehouse>. (Any model can be placed in the Warehouse, but Warehouse models that make it into Google Earth have to meet certain standard for accuracy and placement, and are screened by Google staff.)

3. To get more information on the Coit Tower, click on it when it's highlighted. You will see a window with a description and picture of the model.



If you click on the model in this window, you'll open the model's page in the 3D Warehouse. You can download it, if you like.

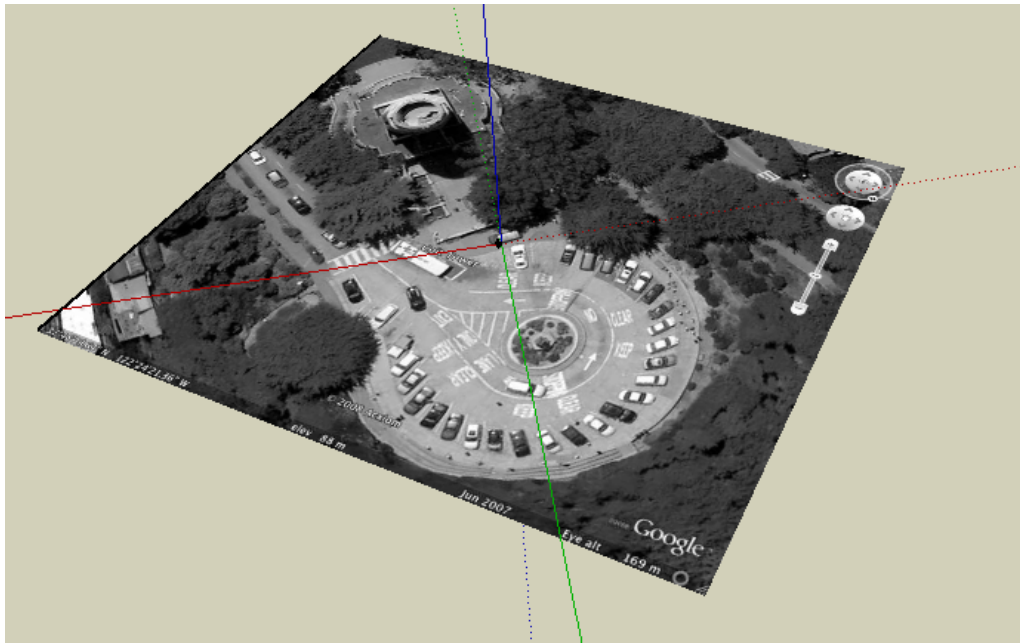
4. Our new building will be placed here, in the center of the traffic circle next to the tower (maybe it's not where you'd ideally want to place a building, but maybe someday they'll move the parking lot). Before going back to SketchUp, you should navigate to a birds-eye view, looking down at the spot for the new building. Make the view large enough to fill the Earth window.



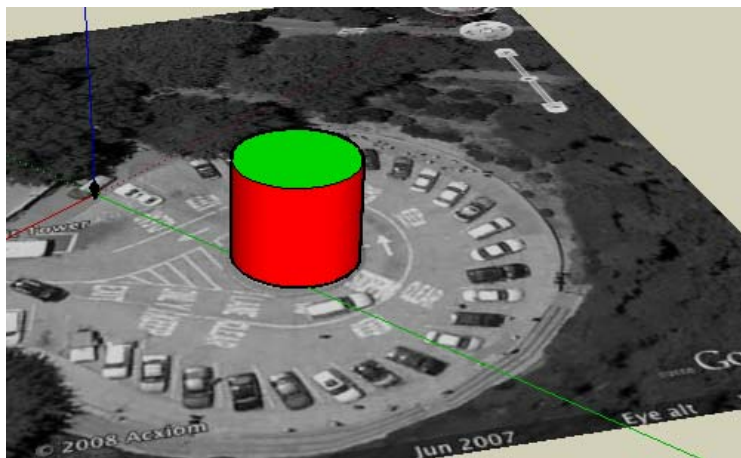
5. Now open SketchUp, and click **Get Current View**.



This takes the view you had in Earth, and places it into SketchUp.



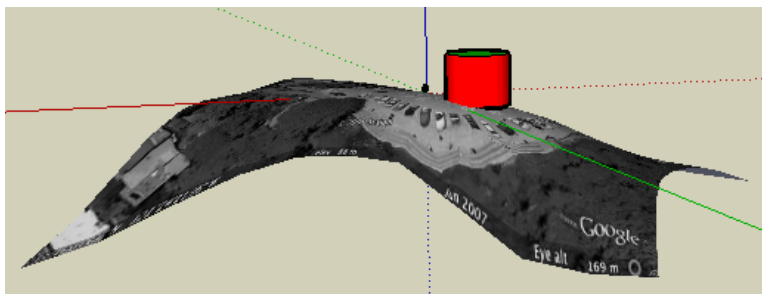
6. To make a simple building, use **Circle** and **Push/Pull** to make a simple cylinder. Place it in the traffic circle, and paint it something bright that will stand out in Earth.



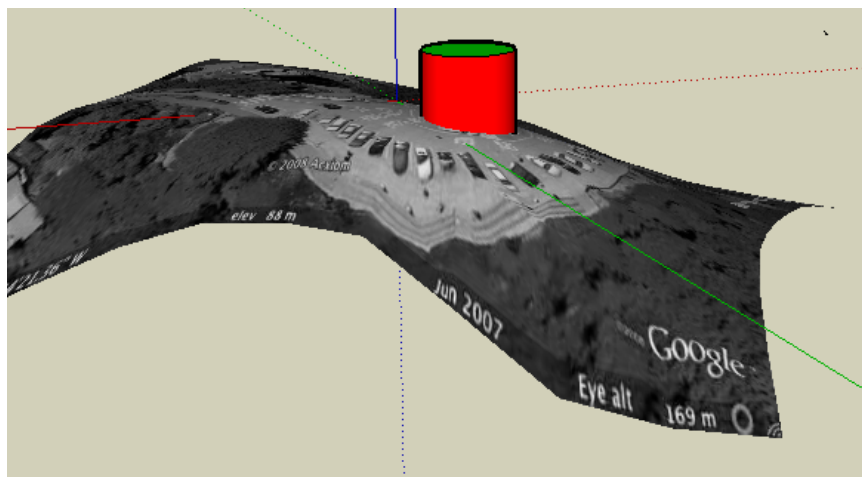
7. The view from Earth looks like a large, flat face, but we know that this spot is on a hill. There are two ways to see an Earth view in SketchUp: as a flat snapshot which we see now, and as accurate terrain (hills and valleys). It's best to start creating your models on the flat view, but you also need to check the terrain view, to make sure the model is in the exact right place. So click **Toggle Terrain**.



Now you can see the hill. Your building might look OK, but mine is now a little off-center, and hanging off the side of the hill.



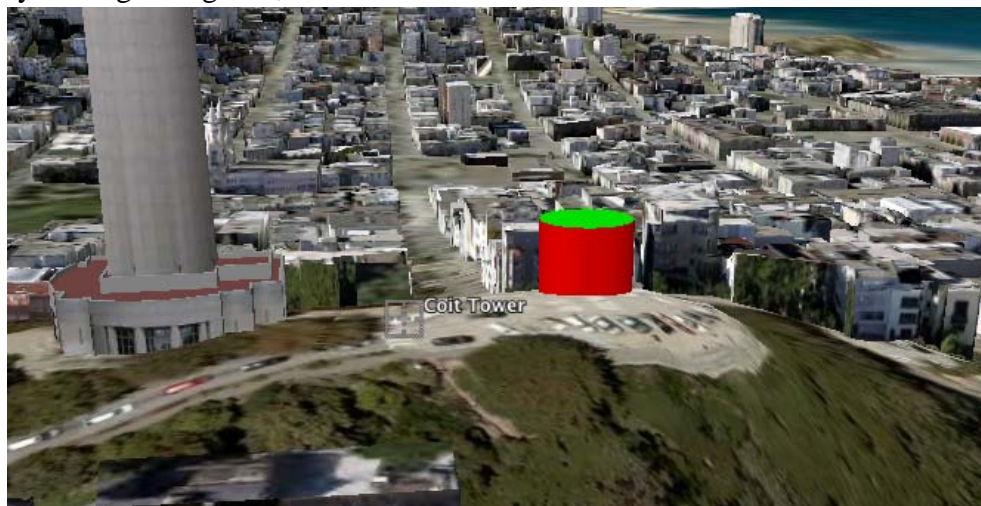
8. So move or rotate the building so that it looks just right.



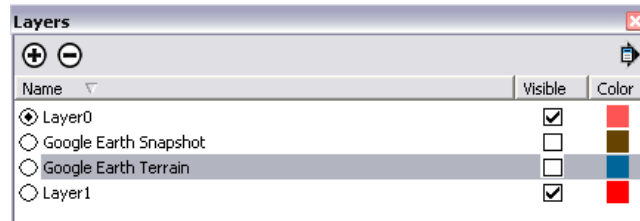
9. Even though this isn't your final building, we can still check how it will look in Earth. Click **Place Model**.



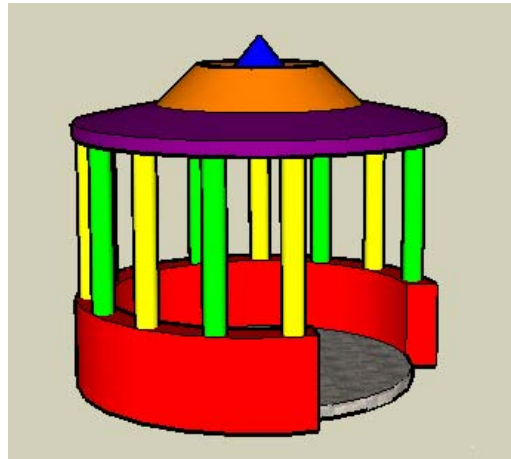
In Earth, the cylinder goes right in, next to the Coit Tower.



10. To change this building, go back to SketchUp. When you want to do some serious work in SketchUp, you probably don't want those Earth views getting in the way. You can't erase or move the views (they are locked), but you can hide them. Both the snapshot (flat) view and the terrain view are placed on their own layer. Open the **Layers** window (**Window / Layers**) and uncheck the **Visible** box for both Earth views.



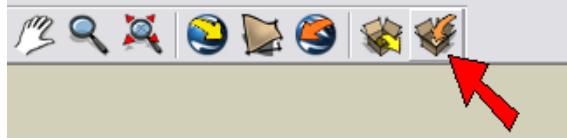
11. Now you can do whatever you want with this building, or erase it altogether and create something new. I made an amphitheater or pavilion - the columns were copied using the **Rotate** tool, and the roof was made using the **Follow Me** tool.



12. Click **Place Model** again, and you'll have to confirm that you want to replace what you did before (the cylinder). Here's a new view of my model, overlooking San Francisco Bay.



13. This model is in your Google Earth as a temporary place - it is not on the “main” Google Earth that everyone sees. If you want to save this place in Earth, use **File / Save / Save Place As**. The file extension is .kmz. You can save your SketchUp file as well, which will keep its location information. If you open a saved SketchUp file with location information, you can always use **Place Model** to see where it ends up in Earth.
14. If you want to upload the model to the 3D Warehouse, click **Share Model**. You’ll need a Google account, which is free and easy to create.

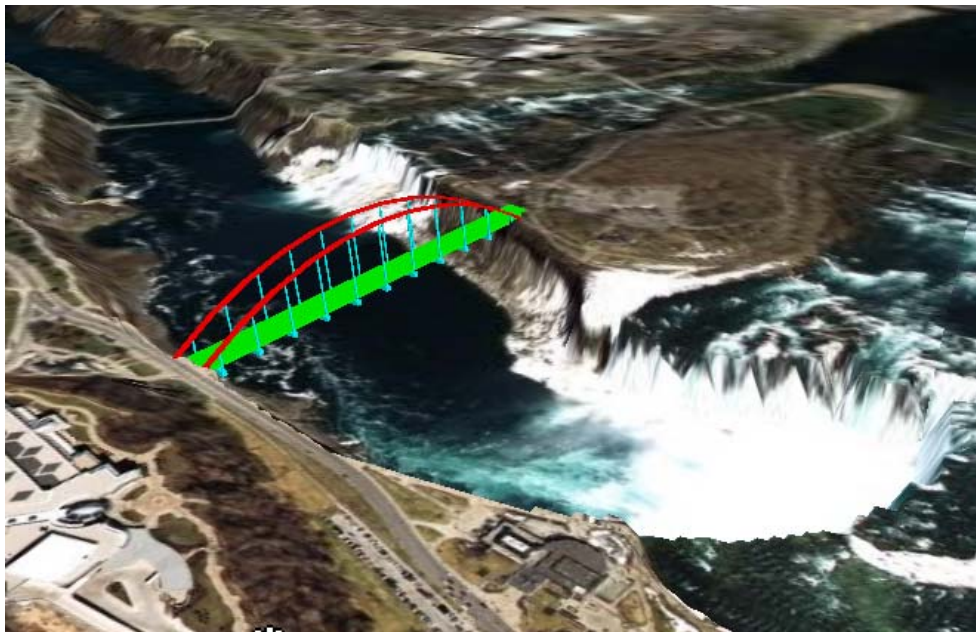


If you have students producing models as part of a class project, you can set up a new Google account for the class as a whole, and create a collection in the Warehouse for the students to use.

When you’re creating a model for a specific location, you don’t have to start by bringing the Earth view into SketchUp. You can build the SketchUp model in “empty space” first, and then bring the Earth view in. You will then have to move, rotate, or size your model to fit the view, and after that you can send the model back to Earth.

Here are some other ideas for projects:

- A bridge over Niagara Falls:



- A rocket next to the Kennedy Space Center.



- Model your school, house or other building in your town, using exact measurements and colors. (If you know how to apply digital pictures to “paint” a model, that’s even better.) If you want your model to appear in Google Earth, make sure to provide an accurate title, an interesting description, and an address. Also check **This 3D model is real, current, and correctly-located**, which will place your model in the queue for the 3D Buildings layer. (Google has a team of designers who accept or reject potential earth models.)

Google 3D Warehouse [| My Models | My Collections |](#)

Upload your model to 3D Warehouse

CoitAmphitheater.skp (340 kb)

Coit Amphitheater

This model is described in the free Teacher Guide, produced by 3DVinci. This is a geography or history project for grades 10 - 12. In this project, you use Google Earth to find some "empty" space next to a famous landmark (the Coit Tower in San Francisco). In SketchUp, you build a new structure on the plot of

teachers, students, elementary, school, kids, classroom, class projects, history, tech ed

This model is geographically located
If your model is incorrectly located please return to SketchUp and change your location.

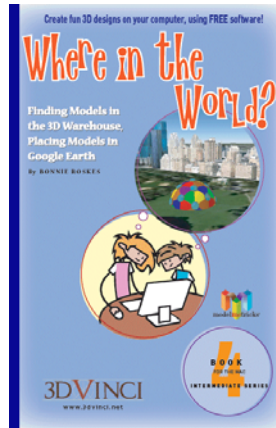
Enter the address of your model

☒ This 3D model is real, current and correctly-located [?](#)

☐ Additional content (includes url, logo, configuration and share settings)

Upload **Cancel**

If you like this project, please check out 3DVinci's book *Where in the World?* (http://www.3dvinci.net/ccp0-prodshow/MI4_PDF.html). This book teaches all you need to know about integrating models into Google Earth, including how to change and relocate models. It also covers how to find just what you need in the 3D Warehouse.



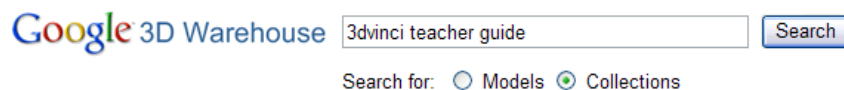
And if you want to receive three ready-to-use projects like these each month, sign up for our *SketchUp Projects of the Month* subscription (<http://www.3dvinci.net/ccp0-prodshow/POM.html>).

All of the models in the Teacher Guide can be downloaded from Google's 3D Warehouse:
<http://sketchup.google.com/3dwarehouse>.

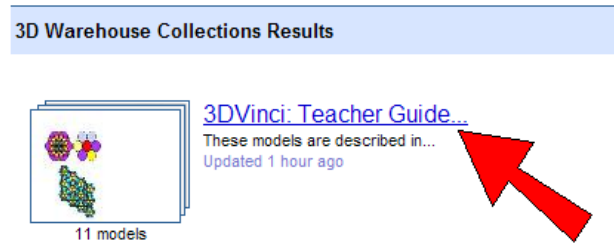
- Click [this link](#) to see the entire Warehouse collection of models used in the Teacher Guide.
- Click [this link](#) to locate the Coit Amphitheater model in the Warehouse.
- Click [this link](#) to locate the Niagara Bridge model in the Warehouse.
- Click [this link](#) to locate the Kennedy Space Center Rocket model in the Warehouse.

If you're reading this as a printed PDF and can't click on the links, here's how to find the Teacher Guide models:

1. Open the 3D Warehouse.
2. In the **Search** field, type "3d vinci teacher guide" and click **Collections**. Then press Enter or click the **Search** button.



3. Open this link:



4. In the collection, find the model you want, and open or download it.